ZETRON®

# Series 2000 Paging Terminals
# Installation and Maintenance

025-9035AA

## Software License

The Zetron software described in this manual is subject to the terms and conditions of Zetron's Software License Agreement, a copy of which is contained on the product distribution media or otherwise provided or presented to buyer. Installation and/or use of the Zetron software constitutes acceptance of Zetron's Software License Agreement.

## Limited Warranty

Buyer assumes responsibility for the selection of the Products and Services to achieve buyer's or its customer's intended results and for the results obtained from the Products and Services. If buyer has provided Zetron with any requirements, specifications or drawings, or if Zetron provides buyer with such materials, such materials are provided solely for buyer's convenience and shall not be binding on Zetron unless agreed contractually by Zetron. UNLESS AGREED CONTRACTUALLY BY ZETRON, ZETRON DOES NOT WARRANT THAT THE PRODUCTS OR SERVICES WILL MEET BUYER'S OR ITS CUSTOMER'S REQUIREMENTS OR SPECIFICATIONS OR THAT OPERATION OF THE PRODUCTS WILL BE UNINTERRUPTED OR ERROR FREE. SUBJECT TO THE LIMITATIONS SET FORTH BELOW, Zetron warrants that all Zetron Products and Services will be free from material defects in material and workmanship for one year from date of shipment or performance of the Services (except where indicated otherwise in the Zetron Price Book). For buyer's convenience, Zetron may purchase and supply additional items manufactured by others. In these cases, although Zetron's warranty does not apply, buyer shall be the beneficiary of any applicable third party manufacturer's warranties, subject to the limitations therein. Zetron's warranty covers parts and Zetron factory labor. Buyer must provide written notice to Zetron within the warranty period of any defect. If the defect is not the result of improper or excessive use, or improper service, maintenance or installation, and if the Zetron Products or Zetron Accessories have not been otherwise damaged or modified after shipment, AS ZETRON'S SOLE AND EXCLUSIVE LIABILITY AND BUYER'S SOLE AND EXCLUSIVE REMEDY, Zetron shall either replace or repair the defective parts, replace the Zetron Products or Zetron Accessories, reperform the Services or refund the purchase price, at Zetron's option, after return of such items by buyer to Zetron. Shipment shall be paid for by the buyer. No credit shall be allowed for work performed by the buyer. Zetron Products or Zetron Accessories which are not defective shall be returned at buyer's expense, and testing and handling expense shall be borne by buyer. Out-of-warranty repairs will be invoiced at the then - current Zetron hourly rate plus the cost of needed components. THE FOREGOING WARRANTY AND THE THIRD PARTY MANUFACTURER'S WARRANTIES, IF ANY, ARE IN LIEU OF ANY AND ALL OTHER WARRANTIES EXPRESSED, IMPLIED OR ARISING UNDER LAW, INCLUDING, BUT NOT LIMITED TO, THE IMPLIED WARRANTIES OF MERCHANTABILITY, NON-INFRINGEMENT AND FITNESS FOR A PARTICULAR PURPOSE.

## Limitation of Liability

Zetron makes no representation with respect to the contents of this document and/or the contents, performance, and function of any accompanying software.

Further, Zetron reserves the right to revise this document or the accompanying software and to make changes in it from time to time without obligation to notify any person or organization of such revisions or changes.

This document and any accompanying software are provided “As Is.” ZETRON SHALL NOT UNDER ANY CIRCUMSTANCES BE LIABLE TO BUYER OR ANY THIRD PARTY FOR ANY INCIDENTAL, SPECIAL, CONSEQUENTIAL OR INDIRECT LOSS OR DAMAGE ARISING OUT OF OR CONNECTED WITH BUYER'S PURCHASE OR USE OF ZETRON PRODUCTS, ZETRON ACCESSORIES OR ZETRON SERVICES. IN NO EVENT SHALL ZETRON'S LIABILITY (WHETHER FOR NEGLIGENCE OR OTHER TORT, IN CONTRACT OR OTHERWISE) EXCEED THE PRICE PAID TO ZETRON FOR THE ZETRON PRODUCTS, ZETRON ACCESSORIES OR ZETRON SERVICES.

IP networks by their nature are subject to a number of limitations, such as security, reliability, and performance. Anyone using non-dedicated IP networks, such as shared WANs or the Internet, to connect to any Zetron Products or systems should consider and is responsible for these limitations.

ZETRON

©2009 Zetron, Inc. All rights reserved. This publication is protected by copyright; information in this document is subject to change without notice. Zetron and the Zetron logo are registered trademarks of Zetron, Inc. Other company names and product names may be trademarks or registered trademarks of their respective owners. This publication may not be reproduced, translated, or altered, in whole or in part, without prior written consent from Zetron, Inc.

## Compliance Statements

This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense.

This equipment meets the applicable Industry Canada Terminal Equipment Technical Specifications. This is confirmed by the registration number. The abbreviation, IC, before the registration number signifies that registration was performed based on a Declaration of Conformity indicating that Industry Canada technical specifications were met. It does not imply that Industry Canada approved the equipment.

The Ringer Equivalence Number (REN) for this terminal equipment is 0.1. The REN assigned to each terminal equipment provides an indication of the maximum number of terminals allowed to be connected to a telephone interface. The termination on an interface may consist of any combination of devices subject only to the requirement that the sum of the RENs of all the devices does not exceed 5.0.

**Information on Disposal of Old Electrical and Electronic Equipment and Batteries (applicable for EU countries that have adopted separate waste collection systems)**

Products and batteries with the symbol (crossed-out wheeled bin) cannot be disposed as household waste. Old electrical and electronic equipment and batteries should be recycled at a facility capable of handling these items and their waste byproducts.

Contact your local authority for details in locating a recycle facility nearest to you.

Pb

Proper recycling and waste disposal will help conserve resources whilst preventing detrimental effects on our health and the environment.

Notice: The sign “Pb” below the symbol for batteries indicates that this battery contains lead.

## Safety Summary

**Warning!** For your safety and the protection of the equipment, observe these precautions when installing or servicing Zetron equipment:

- Follow all warnings and instructions marked on the equipment or included in documentation.
- Only technically qualified service personnel are permitted to install or service the equipment.
- Be aware of and avoid contact with areas subject to high voltage or amperage. Because some components can store dangerous charges even after power is disconnected, always discharge components before touching.
- Never insert objects of any kind through openings in the equipment. Conductive foreign objects could produce a short circuit that could cause fire, electrical shock, or equipment damage.
- Remove rings, watches, and other metallic objects from your body before opening equipment. These could be electrical shock or burn hazards.
- Ensure that a proper electrostatic discharge device is used, to prevent damage to electronic components.
- Do not attempt internal service of equipment unless another person, capable of rendering aid and resuscitation, is present.
- Do not work near rotating fans unless absolutely necessary. Exercise caution to prevent fans from taking in foreign objects, including hair, clothing, and loose objects.
- Use care when moving equipment, especially rack-mounted modules, which could become unstable. Certain items may be heavy. Use proper care when lifting.

## Release History

| Release | Enhancements/Changes |
|---|---|
| **Rev X.1**<br>Mar 2007 | Last release in MS Word format. |
| **Rev Y**<br>04 Jan 2008 | • Document converted to FrameMaker® format.<br>• Material updated to support the release of the ZbaseW and ZlinkW database maintenance tools.<br>• Added installation instructions for connecting the optional Digi One™ SP module to the paging terminal local programming port (page 43) |
| **Rev Z**<br>24 Oct 2008 | • Added material to Table 31 on page 227 to cover the fact that the Block Service codes can now be applied to End-to-End lines as well as trunk lines.<br>• Added a description of the new OPARAM code for "*2-tone format inter-page delay*" on page 229<br>• Added the command "MTTMk7VorD" to the section on the options.cus file. See *MTTMk7VorD* on page 270. |
| **Rev AA**<br>09 Mar 2009 | • Updated the description for Overdial DID on page 223<br>• Updated the description of Telco Line Parameters on page 224<br>• Corrected the descriptions for JP5 and JP6 in Table 11 on page 107 |

# Contents

**Introduction and Specifications . . . . . 13**
Purpose of This Manual . . . . . 13
Contents of This Manual . . . . . 14
System Specifications . . . . . 16
Model 2100 . . . . . 16
Model 2200 . . . . . 16
Model 2200EX . . . . . 17
Lightning Protection . . . . . 17
Operating Power . . . . . 17
Trunk Card Specifications (702-9037 and 702-9117) . . . . . 18
DID Selector Level/PABX Trunk Configuration . . . . . 19
End-to-End/PABX Extension Configuration . . . . . 19
PABX E&M Type I Configuration . . . . . 19
Operator Local Phone Configuration . . . . . 20
Digital T1 Interface . . . . . 20
Multi-Port Card Specifications (702-9191) . . . . . 21
Station Card Specifications (702-9038) . . . . . 21
General Specifications . . . . . 21
Electrical Specifications . . . . . 22
Voice System Specifications . . . . . 23
ITU ADPCM Voice System (950-0385 or 950-0386) . . . . . 23
ADPCM Voice System (950-9061) . . . . . 24

**System Installation . . . . . 25**
Overview . . . . . 25
Installation Checklist . . . . . 26
Alignment Procedure . . . . . 30
Hard Disk Card Mounting Information . . . . . 32
SCSI Disk Card Mounting Information (M2200) . . . . . 32
TELCO Ground Reference . . . . . 33
48 Vdc Ground Jumper . . . . . 33
Model 2200 Cabinet Mounting Information . . . . . 36
Model 2100 Cabinet Mounting Information . . . . . 36
Cable Routing . . . . . 36
Model 2200EX Installation . . . . . 39
General . . . . . 39
Model 2200EX Setup . . . . . 40

Model 2200 Main Chassis Setup . . . . . 41
Power Up Test . . . . . 41
2000 Series Printer Option . . . . . 42
ZCPU Serial Printer Port . . . . . 42
Pentium CPU Card Parallel Printer Ports . . . . . 43
Configuring the Digi One™ SP Option . . . . . 43
Confirming the Serial Port Pinout . . . . . 44
Initial Configuration Using the Digi Software Tool . . . . . 45
Configuration Using a Browser . . . . . 50

**Installing the Office Software . . . . . 55**
Overview . . . . . 55
Office Computer Specification Guidelines . . . . . 55
Specifications . . . . . 56
Dialup Modem Connection to Paging Terminal . . . . . 56
Local Office Computer . . . . . 56
Installing Office Software . . . . . 57
Installing ZbaseW for Multiple Users on a Network . . . . . 57
Installing ZbaseW on the First PC . . . . . 58
Installing ZbaseW on Subsequent PCs . . . . . 59
Starting ZbaseW . . . . . 59
ZbaseW Communications (ZlinkW) . . . . . 60
ZlinkW Property Fields . . . . . 62
Modem Connections . . . . . 63
Local Connections . . . . . 64
Network Connections . . . . . 64
Exiting ZbaseW . . . . . 64
Backups . . . . . 65
Changing ZlinkW Passwords . . . . . 65
Office Computer Operations Guidelines . . . . . 66
Shared PC . . . . . 66
Linking to the Paging Terminal . . . . . 66
Database Operations . . . . . 69
Training and Classes . . . . . 69

**Trunk Cards and Connections . . . . . 71**
Selecting a Phone Line . . . . . 71
Support for T1 Trunks . . . . . 71
TELCO Connectors . . . . . 72
Model 2100 Backplane TELCO Pinouts (702-9133 Rev C - J13) . . . . . 73
Model 2200 Backplane TELCO Pinouts (702-9071 Rev C - J19) . . . . . 74
Model 2200 Backplane TELCO Pinouts (702-9071 Rev C - J20) . . . . . 75
Model 2200 Main and Expansion Chassis Backplane Pinouts (702-9071 Rev E - J23) . . . 76
Adjustment Procedures . . . . . 77
Trunk Cards (702-9037 and 702-9117) . . . . . 77
To Tel Adjustment . . . . . 77
From Tel Adjustment . . . . . 77
Hybrid Adjustment . . . . . 78
Dial Click Card . . . . . 82
MF Decoder Option . . . . . 83
Alarm Option . . . . . 83

Large RAM . . . . . 84
4-Wire Audio E&M . . . . . 84
Audio Daughter Board (4-wire audio E&M) Rev B . . . . . 85
Configuring Trunk Cards (702-9037 and 702-9117) . . . . . 86
Trunk Card Removal/Installation . . . . . 86
Switch Settings . . . . . 87
Jumper Matrix Settings . . . . . 87
Configuring for DID Operation . . . . . 90
Central Office (C.O.) DID Description . . . . . 90
DID Installation . . . . . 90
Operator Local Station . . . . . 91
Configuring for End-to-End Loop Start Operation . . . . . 91
End-to-End Loop Start/PABX Station Description . . . . . 91
End-to-End Installation . . . . . 91
Configuring for PABX Operation . . . . . 92
Private Branch Exchange (PABX) Tie-Trunk Description (E&M) . . . . . 92
Private Branch Exchange (PABX) Ground Start Description (GS) . . . . . 94
Dual Trunk Card Memory Upgrade . . . . . 94

**Radio System . . . . . 97**
Overview . . . . . 97
General System Design . . . . . 97
Radio Connectors . . . . . 98
Model 2100 Backplane Radio Pinouts (702-9133 Rev C - J13) . . . . . 99
Model 2100 Backplane Radio Pinouts (702-9133 Rev C - J14) . . . . . 100
Model 2200 Backplane Radio Pinouts (702-9071 Rev C - J19) . . . . . 101
Model 2200 Backplane Radio Pinouts (702-9071 Rev C - J20) . . . . . 102
Model 2200 Backplane Radio Pinouts (702-9071 Rev C - J21) . . . . . 103
Model 2200 Backplane Radio Pinouts (702-9071 Rev C - J22) . . . . . 104
Station Card Removal/Installation . . . . . 105
Switch Settings . . . . . 105
Jumper Settings . . . . . 106
Station Card Adjustments . . . . . 107
Radio Signal Descriptions . . . . . 109
Co-located Radio Station . . . . . 110
Modifications for TTL Data Signal Levels . . . . . 111
Co-located Motorola PURC Station . . . . . 112
Remote Control Options (950-9074 and 950-9111) . . . . . 113
Zetron Model 66 Transmitter Control Panel . . . . . 114
Motorola PSC/SSC/DDC Controller . . . . . 115
Motorola ASC (Advanced Simulcast Controller) . . . . . 116
TX Link Controllers . . . . . 117
Quintron 1000 Exciter Hookup . . . . . 118
Connecting Zetron 2000 Series to Glenayre Transmitter . . . . . 118

**Multiport Serial TAP Input . . . . . 119**
Overview . . . . . 119
Paging Terminal Requirements for the Multiport Card . . . . . 119
General Information . . . . . 119
Option Details . . . . . 120
ZbaseW . . . . . 120

Installation and Configuration . . . . . 121
General . . . . . 121
Information Needed . . . . . 121
Hardware Installation . . . . . 121
Connections . . . . . 122
Miscellaneous . . . . . 122
Software Configuration . . . . . 123
Multiport Configurations . . . . . 124
Connecting Multiport Hardware to RS-232 Connectors . . . . . 124
UDS 202T Modem Hookup Example . . . . . 128
Pinout for the Siemon S66M Punchdown Block . . . . . 129
Multiport Wire List . . . . . 130
Octal RS-232 Cable Used with the Multiport Card . . . . . 131

**Multiport for TNPP and TAP Outdial . . . . . 133**
TNPP Overview . . . . . 133
TNPP Details . . . . . 133
Types of Packets . . . . . 136
Types of Links . . . . . 136
TNPP Limitations and Specifications . . . . . 137
Limitations of TNPP . . . . . 137
Our Current TNPP Limitations . . . . . 137
Limitations of Multi-node TNPP . . . . . 137
Items Supplied for this Configuration . . . . . 138
Port Configuration . . . . . 138
Using TNPP with ZbaseW v310 and Zpage v310 . . . . . 139
Network CUS Parameter File . . . . . 140
Configuration - TNPP Addresses . . . . . 140
Software Configuration . . . . . 141
Limitations of Single-node TNPP (Older Systems) . . . . . 141
Format of TNPP Related Log File Postings . . . . . 142
TNPP Link Tips - UDS 202T and Leased Line . . . . . 144
TAP Outdial . . . . . 146
Modem Related Information . . . . . 146
OPARAM CDS Settings . . . . . 147
NETWORK.CUS Settings . . . . . 147
TAP Outdial Processing . . . . . 148
TAP Outdial Status . . . . . 148

**Theory of Operation . . . . . 149**
Overview . . . . . 149
System Startup . . . . . 149
System Operation . . . . . 150
CPU Indicators . . . . . 150
Idle . . . . . 150
Call Processing . . . . . 151
CPU Card (702-9176) . . . . . 151
Modem Card (802-0041) . . . . . 153
SCSI . . . . . 153
2200EX . . . . . 154
Dual Trunk Card (702-9117) Rev D and Later . . . . . 154

Dual Trunk Card — 4-Wire E&M (702-9318) . . . 156
Multiport Serial Card (702-9191) . . . 156
Dual Dial Click Option (for 702-9117) . . . 157
MF Decoder Option . . . 158
Station Card . . . 158
Station Card II (702-9441) . . . 158
Call Processing Flow Charts . . . 159
Central Office DID (Selector Level) . . . 160
End-to-End Loop Start (Central Office/PABX Station) . . . 161
End-to-End Ground Start (PABX Trunk) . . . 162
PABX Trunk (Tip-Ring Loop) . . . 163
PABX Tie-Trunk (E&M) . . . 164
Operator Local Phone . . . 165
TELCO Signal Descriptions . . . 166
Central Office DID (Selector Level) . . . 166
Central Office End-to-End . . . 166
PABX E&M Type I Tie-Trunk (2-wire audio) . . . 167
Simplified TELCO Configuration Schematics . . . 167
End-to-End Configuration (024-0009A) . . . 168
DID Configuration (024-0010A) . . . 169
E&M Configuration (024-0011A) . . . 170
Ground Start Configuration (024-0012A) . . . 171
Dual 4-wire Configuration (024-0100A) . . . 172
TELCO Interface Timing Diagrams . . . 173
Radio Interface Timing Diagrams . . . 175
Timing Diagrams for External TX Control Unit . . . 176

**Troubleshooting and Repair Procedures . . . 179**
Troubleshooting the Paging Terminal . . . 179
Swapping Cards . . . 182
Front Panel Lights . . . 182
Progress Tones . . . 184
DIP Switches and Matrix Plugs . . . 184
Recommended Maintenance . . . 185
Troubleshooting the Office Computer . . . 186
Additional ZlinkW Troubleshooting Information . . . 187
General Information . . . 187
Office Computer . . . 187
Serial Ports . . . 188
Paging Terminal Local Connect Option . . . 188
Modem Connect . . . 189
Modem Setup - Software . . . 190
Connections . . . 191
Local Connect . . . 191
Phone Line Connect . . . 191
ZbaseW Setup . . . 192
Running ZlinkW . . . 192
Troubleshooting . . . 193
Garbage on Screen . . . 193
Check Terminal Modem . . . 193
Check PC Modem . . . 193
Other Checks . . . 194

Machine/Environment . . . . . 194

**Voice Storage System . . . . . 197**
Overview . . . . . 197
ITU ADPCM Cards (702-0065 and 702-0066) . . . . . 198
Slots . . . . . 198
Address Settings . . . . . 198
Mode Settings (ITU ADPCM Cards 702-0065 and 702-0066) . . . . . 198
Audio Level . . . . . 199
Test Pins (ADPCM Cards 702-0065 and 702-0066) . . . . . 199
“Old” ADPCM Card (702-9153) . . . . . 199
Slots . . . . . 199
Address Settings . . . . . 200
Mode Settings (ADPCM Card 702-9153) . . . . . 200
Audio Level . . . . . 200
Test Pins (ADPCM Card 702-9153) . . . . . 200
Upgrades . . . . . 201
Installing New ICs in the Voice Card . . . . . 201
Adding Second ADPCM Card . . . . . 202
Operation . . . . . 203
Power Up . . . . . 203
Record/Play . . . . . 204
Silence Deletion . . . . . 204
Lights . . . . . 205
Maintenance . . . . . 205
Voice File Restore and Backup . . . . . 205
Single Files . . . . . 207
Client Prompts . . . . . 208
Mirrored Drive Syncronizing (Obsolete) . . . . . 209
RAID Hard Drive . . . . . 210
RAID Drive Option Installation (011-0662) . . . . . 210
IDE Hard Drive Installation Instructions (011-0663) . . . . . 212
Transferring Files from Old SCSI Drive to RAID Drive (011-0664) . . . . . 212
Creating Batch Files for Transferring Custom Greeting Voice Prompts . . . . . 214
IDE Disk Drive Duplicate Procedure (011-0665) . . . . . 215

**System Configuration Files . . . . . 217**
Overview . . . . . 217
CONFIG.CDS File . . . . . 218
OPARAM.CDS File . . . . . 218
File Format for OPARAM.CDS . . . . . 219
Trunk Card OPARAM Codes . . . . . 219
Station Card OPARAM Codes . . . . . 229
Multi-port Serial Card OPARAM Codes . . . . . 238
OPARAM Programming/TNPP Networking Using Version 8TNPP8C3 . . . . . 242
Node Table Programming . . . . . 243
Port Programming . . . . . 244
Physical Node ID . . . . . 247
Sample OPARAM.CDS . . . . . 248
Enhanced Packet Routing . . . . . 248
TAP Outdial OPARAM Codes . . . . . 251

Per-destination Parameters . . . 251
Modem-related Parameters . . . 257
Modem Programming Strings . . . 258
The ".CUS" Files . . . 260
Commands Found in OPTIONS.CUS . . . 260
Generic Function Codes . . . 277
Load Management . . . 281
Commands within TRUNKS.CUS . . . 284
Trunk-based Function Code Override Feature . . . 292
Commands within NETWORK.CUS . . . 294
TNPP and System Startup Events Reporting . . . 300
Types of Events . . . 300
Actions Taken . . . 301
System Configuration Files . . . 301
EVENTS.CUS . . . 301
Events Table . . . 302
NETWORK.CUS . . . 303
Log Posting . . . 304

**Remote Maintenance . . . 307**
Overview of Communication with Paging Terminal . . . 307
Installing ZlinkW . . . 308
Starting and Exiting ZlinkW . . . 308
Configuring Communications from within ZlinkW . . . 309
ZlinkW Properties Fields . . . 310
Making a Connection from ZbaseW . . . 312
Modem Connections . . . 313
Local Connections . . . 313
IP Network Connections . . . 314
ZlinkW Command Reference . . . 314
ZlinkW File Operations . . . 321
ZlinkW "cards" . . . 322
ZlinkW "date" . . . 324
ZlinkW "dos" . . . 324
ZlinkW "faultoff" . . . 324
ZlinkW "get" . . . 324
ZlinkW "lastboot" . . . 325
ZlinkW "liu" . . . 325
ZlinkW "log" . . . 328
ZlinkW "logopen" . . . 328
ZlinkW "ls" . . . 329
ZlinkW Mailbox . . . 331
ZlinkW "newsdb" . . . 331
ZlinkW "niu" . . . 331
ZlinkW "note" . . . 334
ZlinkW "page" . . . 335
ZlinkW "reboot" . . . 338
ZlinkW "repeat" . . . 338
ZlinkW "search" . . . 339
ZlinkW "siu" . . . 340
ZlinkW "tail" . . . 342
ZlinkW "time" . . . 342

ZlinkW “traffic” . . . 342
ZlinkW “vls” . . . 343
ZlinkW “vget”, “vput” . . . 344
ZlinkW Command Switches . . . 345
Date & Time Switches . . . 345
Switch Stacking . . . 346
Getting Help . . . 346
Log Posting Format . . . 346
Paging Format Letters . . . 347
Overdialed And Call Recycle Posting . . . 349
New Destination Type (Log +) . . . 349
“set” Command . . . 350
Posting . . . 351
Classes of Calls . . . 352
Results of Calls . . . 354
Sucess Results . . . 354
Failure Results . . . 355
Warning Results . . . 356
Error Results . . . 357
System Errors (Call not processed) . . . 357
Typical Bootup Sequence . . . 358
Paging Traffic Display . . . 359

**Appendix A: TAP Protocol Summary . . . 361**
Definitions . . . 362
Protocol . . . 362
Initial Handshake Sequence . . . 362
Initial Logon Sequence . . . 363
Transferring Pages . . . 364
Checksum Example . . . 366

**Appendix B: ASCII Table — 7 Bit . . . 367**
Control Codes . . . 367
Printable Characters . . . 368

**Appendix C: Decimal to HEX Conversion . . . 369**
Overview . . . 369
Examples . . . 370

**Index . . . 373**

# Introduction and Specifications

## Purpose of This Manual

This manual is provided to assist you in the installation of your Zetron 2000 Series Paging Terminal. Step-by-step installation instructions are provided to simplify the process. Also provided in this manual is information relating to adjustments, troubleshooting, theory of operation, and a complete list of equipment specifications.

# Contents of This Manual

This manual is divided into twelve sections and three appendices. The following paragraphs contain a synopsis of each section and describe the basic purpose and content of each.

- INTRODUCTION AND SPECIFICATIONS
  This section contains the specifications for the paging terminal as well as the trunk cards, station cards, voice storage system, etc.
- SYSTEM INSTALLATION
  This section contains the information necessary to install and adjust the paging terminal. The information is contained in the form of checklists and step-by-step procedures. Where appropriate, procedures in this section refer to information contained in other sections of this manual. This is the first section you will read in this manual.
- INSTALLING THE OFFICE SOFTWARE
  This section discusses the connection of the office computer to the paging terminal. A simple procedure is given to load the software. It also covers starting and exiting the database program.
- TRUNK CARDS AND CONNECTIONS
  This section provides information that relates to the telco side of the paging terminal. It contains detailed connection listings for the RJ21 trunk connectors located on the backplane of the paging terminal that are used to make the connections to the telephone company lines. It also tells how the trunk cards operate and how to configure a trunk card for DID, E&M, or E-E operation. Adjustment procedures are given for the trunk cards as well as for the optional dial click cards.
- RADIO SYSTEM
  This section provides information that relates to the radio side of the paging terminal. It contains detailed connection listings for the radio station connectors located on the backplane of the paging terminal that are used to make the connections to the radio transmitter equipment. It also tells how the station cards operate and how to configure the jumpers on a station card and make any necessary adjustments. This section also describes the different paging terminal/radio transmitter hook-up arrangements, including remote control operation. Illustrations are provided to support the hook-up descriptions.
- MULTIPORT SERIAL TAP INPUT
  This section describes the installation and operation of the multiport serial card for alphanumeric page entry and its function as a TNPP interface.
- MULTIPORT FOR TNPP & TAP OUTDIAL
  This section presents an overview of TNPP networking for paging terminals and general information on Zetron's implementation of TNPP. It covers usage of TNPP with various ZbaseW and ZPAGE versions and describes the information used to configure TNPP on a terminal.

- THEORY OF OPERATION
  This section presents the theory of operation for the paging terminal. Circuit descriptions are provided for each of the cards. This section also contains a complete set of charts that describe the sequence of events that takes place when call are processed by the paging terminal (call processing charts). A complete set of timing diagrams for the telco side of the system and the radio side of the system is contained at the back of the section.
- TROUBLESHOOTING AND REPAIR PROCEDURES
  This section provides some troubleshooting information that you can use when clearing problems in the paging terminal. The information provided covers symptoms/remedies, front panel lamp indications, progress tones, and the office computer.
- VOICE STORAGE SYSTEM
  This section describes the voice storage system used in the paging terminal. It describes the operation of the voice system, how to install the voice card, how to set the mode switches on the card, how to use the test pins to troubleshoot the voice card, and how to upgrade the software on the card. It also covers how to save and restore sets of voice files or individual voice files.
- SYSTEM CONFIGURATION FILES
  This section describes the oparam.cds and various configuration control files. This file contains information about your system that is used by the microprocessor and its software to control your paging terminal. While this file is created at the factory to suit your particular needs, it is described in this section in the event you wish to change the configuration of your system. To determine just what aspects of paging terminal operation this file controls, read the entire section and examine A copy of your oparam.cds file using a text editor or the DOS type command.
- REMOTE MAINTENANCE
  This section describes the operation of ZlinkW; the full-duplex Zetron communications program provided to remotely control your paging terminal.
- APPENDIX A. TAP PROTOCOL SUMMARY
  This appendix describes the Telocator Access Protocol (TAP), which is a protocol derived from the Motorola iXO protocol.
- APPENDIX B. ASCII TABLE, 7-BIT
- APPENDIX C. DECIMAL TO HEX CONVERSION

# System Specifications

## Model 2100

| Parameter | Description |
|---|---|
| Physical | 21" tall, 20" wide, 5.5" deep (wall mount)<br>19" rack, 12 rack units tall, 5.5" deep (rack mount)<br>40 lb. fully configured<br>Wall or rack mounting |
| Power Supply | AC input: 115/230 volts AC +/- 10%, 47-63 Hz<br>150 Watts maximum |
| Uninterruptible Power Supply | 400 VA<br>30 minute capacity |
| Environmental | +40 to +120 degrees Fahrenheit<br>(+5 to +50 degrees Celsius)<br>10,000 foot (3,000 meter) altitude<br>8% to 80% relative humidity, non-condensing |
| Card Slots | 5 computer, 3 telco, 2 telco/radio<br>Positive lock retainer bars |

## Model 2200

| Parameter | Description |
|---|---|
| Physical | 30" tall, 22" wide, 7" deep<br>75 lb. fully configured<br>Wall or frame mounting |
| Power Supply | AC input: 115/230 volts AC +/- 10%, 47-63 Hz<br>DC input option: 40-70 volts DC<br>300 Watts maximum |
| Uninterruptible Power Supply | 400 VA<br>30 minute capacity |
| Environmental | +50 to +120 degrees Fahrenheit<br>(+10 to +50 degrees Celsius)<br>10,000 foot (3,000 meter) altitude |
| Card Slots | 6 computer, 6 telco, 4 telco/radio<br>Positive lock retainer bars |

## Model 2200EX

| Parameter | Description |
|---|---|
| Physical | 30" tall, 22" wide, 7" deep<br>75 lb. fully configured<br>Wall or frame mounting |
| Power Supply | AC input: 115/230 volts AC +/- 10%, 47-63 Hz<br>200 Watts maximum |
| Environmental | +40 to +120 degrees Fahrenheit<br>(+5 to +50 degrees Celsius)<br>10,000 foot (3,000 meter) altitude<br>8% to 80% relative humidity, non-condensing |
| Card Slots | 6 computer, 10 telco, 4 telco/radio<br>Positive lock retainer bars |

## Lightning Protection

Arc arresters right on the telephone demarcation/punch-down blocks can shunt hazardous voltages at their source. These easily replaced protection modules protect your equipment investment and increase client satisfaction. Ask your Zetron sales person how to order punch down blocks with built in protectors.

**Caution!** Operating the 2100/2200/2200EX without adequate voltage suppression devices on the telephone and radio connections may result in costly damage not covered by warranty. Protection kits and applications assistance are available from Zetron.

## Operating Power

The internal power supply on the Model 2100/2200/2200EX operates from 115 or 230 volts AC and provides all internal operating voltages, including the 48 volts for DID telephone trunks. A power supply option is available to operate the Model 2200 directly from 48V telco-style battery supply.

An uninterruptible power supply (UPS) option (802-9049) obtains standby power from storage batteries and keeps the system operating through brownouts or blackouts. Zetron's standard UPS is a 400VA unit with 30 minute capacity (P/N 802-9049) with built in storage batteries. Higher capacity UPS options may be available as required. With an uninterruptible power supply, the paging messages can go into high capacity storage (up to 30 minutes of typical paging) until the power returns. DID trunks remain in service to keep the telephone company happy. With the radio station also on uninterruptible power, paging and messaging traffic can ride through power losses with no interruption of service. Other UPS equipment can provide more capacity and even power radio equipment; call Zetron for applications assistance.

# Trunk Card Specifications (702-9037 and 702-9117)

| Parameter | Description |
|---|---|
| Field Configured | Central office DID selector-level<br>PABX 2-wire trunk<br>End-to-End loop start ring and overdial<br>E&M Type I 2-Wire Audio (FIC TL-11E)<br>Local operator telephone set/CRT/computer<br>End-to-End ground start and overdial |
| Alpha Messaging | Remote TAP compatibility (requires modem option)<br>Local RS-232C or VDT (702-9037 only)<br>ASCII 7 bits, 2-Stop, Even Parity |
| Card Status Lamps | Select, Test 1, Test 2, Test 3 |
| Line Status Lamps | Ring, Loop, Answer, Modem |
| Input | DTMF 16-tone pairs (0-9,*,#,A-D)<br>Dial pulse (digits 0-9)<br>Modem 300-baud ASCII (1200-baud 702-9117 only)<br>Dial click option (digits 0-9)<br>MF decoder option |
| Connector | Board edge to 50-pin RJ2EX for 10 telcos |
| Telco Audio Input | Voice AGC limited -28 dBm to +10 dBm<br>DTMF overdial tones -35 dBm to +6 dBm<br>Modem tones -35 dBm to -6 dBm<br>Voice silence detect -20 dBm +/-3 dBm threshold<br>Progress tones designed for networking |
| Telco Audio Output | Progress tones/voice -17 dBm to -6 dBm<br>DTMF, Modem tones -13 dBm to -3 dBm |
| Audio Bandwidth | 300 to 3500 Hz +/-1 dB |
| DTMF Detect | Standard 16-tone pair frequencies<br>Minimum tone-pair duration 45 ms<br>Minimum Inter-digit Time 45 ms<br>Up to 11 digits per second |
| Disconnect | no loop current (programmable, 150 ms & up) |
| Detect | no VOX (programmable, 2500 ms & up)<br>dial tone detect (programmable, 3000 ms & up)<br>digit input timeout (programmable, 5 sec. & up) |
| Modem Data | 300- or 1200-baud 103J Answer/Originate<br>Programmable byte framing, XON/XOFF Burst Handshake |
| Line Coupling | 600-ohm Transformer, Adjustable balance duplex hybrid |
| FCC Registration | EYB5Q5-19269-OT-E, REN: 0.4B |
| DOC Registration | 702-9117 Revision D and later only trunk circuits.<br>Load Number: 69 |

## DID Selector Level/PABX Trunk Configuration

| Parameter | Description |
|---|---|
| Connections | 2-wire Tip, Ring |
| Supervision | Reverse battery |
| Battery Source | To telco 48 V +/-3 V DC<br>Current limited 40 mA +/-10 mA |
| Loop Closure | Detect threshold 6 mA +/-3 mA |
| Pulse Acceptance | Rate 5 to 22 pulses per second<br>Minimum inter-digit time 78 ms<br>DTMF acceptance 40 to 300 ms |
| Supervision Control | Immediate dial 150 ms +/-50 ms<br>Wink start delay 240 ms +/-20 ms |

## End-to-End/PABX Extension Configuration

| Parameter | Description |
|---|---|
| Connections | 2-wire Tip, Ring; Loop or Ground Start |
| Battery Source | From Telco/PABX |
| Ring Detect | 16 Hz to 66 Hz; 40 V to 150 V ACRMS |
| Answer After Ring | Programmable 0 to 30 seconds delay |

## PABX E&M Type I Configuration

| Parameter | Description |
|---|---|
| Connections | 5-wire Tip, Ring, E, M, Earth |
| Supervision | Closure to -48V on M-lead<br>Closure to ground on E-lead[1] |
| Battery Source | From Telco / From Terminal; Current limited 15mA[1] |
| Pulse Acceptance | Rate 5 to 22 pulses per second<br>Minimum inter-digit time 78 ms<br>DTMF acceptance 40 to 300 ms |
| Answer Supervision | Closure to ground on E-lead 150 ms +/-50 ms<br>Closure to -48V on M-lead[1] |

[1] Special Matrix plug on 702-9117 only.

### Operator Local Phone Configuration

| Parameter | Description |
|---|---|
| Connections | 2-wire tip, ring |
| Supervision | Reverse battery, answer beeps or computer modem |
| Battery Source | To phone 48 +/- 3 V DC; Current limited 40 +/- 10 mA |
| Loop Closure | Detect threshold 6 mA +/- 3 mA |
| Pulse/DTMF Acceptance | (see *DID Selector Level/PABX Trunk Configuration* on page 19) |

## Digital T1 Interface

| Parameter | Description |
|---|---|
| System Requirements | 2000 Series Paging Terminal must have high performance Pentium CPU card |
| Capacity | Up to 24 channels of T1 support per each T1 Interface (partial T1 trunk support can be achieved using fewer trunk cards)<br><br>A 2000 Series Paging can support two T1 Interface units for a total of 48 channels |
| Compatible CSU units | Interface to PSTN requires the use of a CSU, approved units are:<br>Import T1 CSU 1544<br>AT&T ESF CSU 551E-L1, A<br>(Please contact Zetron for information on any additional CSU units that may have been added to the list.) |
| Power | AC Input 85 to 264 VAC at 47 to 440 Hz, 130 W max.<br>DC (Optional) 36 to 76 VDC |

# Multi-Port Card Specifications (702-9191)

| Parameter | Description |
|---|---|
| Input | 2, 4, 6 or 8-port<br>ASCII 7 bits, 1 stop, even or odd parity<br>ASCII 8 bits, 1 stop, no parity<br>150, 300, 600, 1200 or 9600 baud |
| Card Status Lamps | Select, Test 1, Test 2, Test 3 |
| Port Status Lamps | Channel 1, Channel 2, Channel 3, Channel 4 Channel 5, Channel 6, Channel 7, Channel 8 |
| Connector | Punchdown block via supplied interface cable<br>- or -<br>2000 Series Octopus Cable (709-5008) |
| Controls | Eight-position DIP switch to select card address |

# Station Card Specifications (702-9038)

## General Specifications

| Parameter | Description |
|---|---|
| Configurations | Transmit only Paging<br>Transmit/Receive Talk-back |
| Signaling Formats | 2-tone sequential<br>5/6-tone sequential<br>HSC analog<br>POCSAG binary digital<br>GSC binary digital<br>NEC D3, D4 binary digital<br>Multitone Mark IV/V (special order)<br>FLEX 1600 Baud<br>Software loadable format expansion |
| Batching | Multiple batches<br>Automatic priority aging |
| Morse Code ID | Programmable automatic station ID<br>1200 Hz at 20 wpm |
| Connector | Board edge to 50-pin connector |
| Card Status Lamps | Select, Test 1, Test 2, Test 3 |
| Channel Status Lamps | Request, COR/CAS, Analog PTT, Digital PTT, Data Busy, Aux, Zone 1, Zone 2, Zone 4, Zone 8 |
| Remote Control | GE/Motorola tone remote option |

| Parameter | Description |
|---|---|
| Compatible Controllers | Motorola PSC, SSC<br>Quintron Omega<br>Microlink 20T<br>Controllers with Ana PTT, Dig PTT, Audio, and Data<br>• Must be true FSK (i.e. NRZ)<br>• PURC or Cresent controlled transmitter |

## Electrical Specifications

| Parameter | Description |
|---|---|
| Transmit Audio | Balanced 600 ohm transformer<br>250 Hz to 3500 Hz +/-1dB<br>Voice Level Adjustable -20dBm to +4dBm<br>Tone Level Adjustable -20dBm to +4dBm<br>Selectable Flat Tone or -6 dB per octave De-emphasis 300-3000Hz<br>Selectable Flat Voice or +6 dB per octave Pre-emphasis |
| Format Encoding | Analog frequency accuracy +/-0.02%<br>Analog tone distortion less than 0.2%<br>Digital data stability +/-2 ppm |
| Receive Audio | Balanced 600 ohm transformer<br>Adjustable Level -20dBm to +10dBm<br>Selectable Flat Frequency or -6 dB per octave De-emphasis |
| Digital Encoding | Binary data<br>Analog/digital mode<br>Programmable polarity and timing<br>RS-232 level compatible |
| Zone Select | 4 zone selects (1-16 zones)<br>Open collector, 40 mA sink |
| Keying Outputs | 3 relays, SPDT contacts<br>rated, 1 Amp at 26 V AC<br>Analog PTT, Digital PTT, Aux PTT |
| Station Handshaking | Request station (output)<br>Station busy (COR/CAS input)<br>Terminal busy (input)<br>Selectable polarity<br>Programmable timing<br>RS-232 level compatible |

# Voice System Specifications

## ITU ADPCM Voice System (950-0385 or 950-0386)

| Parameter | Description |
|---|---|
| Audio In/Out | 8-bit PCM with u-Law companding to 12 bits<br>Time division PCM multiplexed audio highway |
| Audio Bandwidth | 200 Hz to 3400 Hz, +/- 1 dB |
| Recording Method | Transcoding to 4-bit ADPCM at 32Kbits/sec<br>Double buffers for each channel<br>DMA transfer to hard disk for permanent storage |
| Storage | Files in protected partition of hard disk<br>End-of-file indication for precise audio cutoff |
| Message Length | No minimum<br>Maximum limited only by mass memory capacity<br>(although the paging terminal may limit voice recordings to a more practical size) |
| End of Message | Precision replay without wasting voice time |
| Pause Compression | Software selectable<br>Performed before disk transfer to conserve activity<br>Fast audio attack prevents initial syllable cutoff, also minimizes noise falsing<br>Selectable decay rate allows customized pause length |
| Operation | Standard card = 14 independent channels<br>High capacity card = 28 independent channels<br>Each may be recording or playing<br>Entirely software controlled by the paging terminal, no special training required for callers<br>Diagnostics and error recovery provided by the paging terminal control software |
| LED Indicators | One LED to show voice memory activity<br>One LED to show program memory activity<br>Two LEDs for test information<br>Four LEDs to indicate channel activity |

## ADPCM Voice System (950-9061)

| Parameter | Description |
|---|---|
| Audio In/Out | 8-bit PCM with u-Law companding to 12 bits<br>Time division PCM multiplexed audio highway |
| Audio Bandwidth | 200 Hz to 3400 Hz, +/- 1 dB |
| Recording Method | Transcoding to 4-bit ADPCM at 32Kbits/sec<br>Double buffers for each channel<br>DMA transfer to hard disk for permanent storage |
| Storage | Files in protected partition of hard disk<br>End-of-file indication for precise audio cutoff |
| Message Length | No minimum<br>Maximum limited only by mass memory capacity<br>(although the paging terminal may limit voice recordings to a more practical size) |
| End of Message | Precision replay without wasting voice time |
| Pause Compression | Software selectable<br>Performed before disk transfer to conserve activity<br>Fast audio attack prevents initial syllable cutoff, also minimizes noise falsing<br>Selectable decay rate allows customized pause length |
| Operation | Sixteen independent channels<br>Each may be recording or playing<br>Entirely software controlled by the paging terminal, no special training required for callers<br>Diagnostics and error recovery provided by the paging terminal control software |
| LED Indicators | One LED to show voice memory activity<br>One LED to show program memory activity<br>Two LEDs for test information<br>Four LEDs to indicate channel activity |

# System Installation

## Overview

This section contains the information necessary to install and adjust the paging terminal. The information is contained in the form of checklists and step-by-step procedures. Where appropriate, procedures in this section refer to information contained in specific sections elsewhere in this manual.

Installation of the 2000 Series Paging Terminal is usually accomplished in three major steps:

- Connect a telco line (or local telephone) and the radio system in a temporary setup for checkout and make it ready for rapid cut over into an existing system. (If this is a new installation, you can install the system in its permanent location and connect the new telco lines for checkout.)
- Install the system software onto the office computer, enter pagers into the database, and perform some test paging operations.
- Mount and connect the working system into its permanent installation.

The installation procedures contained in this section consist of the three basic operations listed above to connect the system temporarily, perform some test pages, and then install the paging terminal in its permanent location. An installation procedure/checklist is provided that lists the specific steps to take during installation of the paging terminal, and where necessary, refers to more detailed information contained in other sections of this manual.

To install the paging terminal in your facility, complete each of the steps (in order) of the Installation Checklist contained on the following pages.

**Warning!** ALWAYS TURN OFF POWER BEFORE INSERTING OR REMOVING CARDS!
Removing or inserting cards with power on can cause serious damage to your terminal. The 2000 Series Paging Terminals use a bus backplane much like a personal computer, and are not designed for "hot" removal of cards.

# Installation Checklist

This installation checklist is provided as a "to do" list that will guide you through the steps necessary to install the paging terminal and its operating software. Follow the steps in the checklist to install the paging terminal.

This checklist consists of specific instructions, and in some instances, references to other instructions contained in this manual. When a step in the installation checklist refers you to another procedure in the manual, complete that procedure and then return to where you left off in the checklist.

1. [_] Unpack and open the paging terminal cabinet.
   Unpack the Model 2100/2200 from largest box (save the box).
   Remove the front door (screw latches on Model 2200)
   Remove the top cover (unscrew, slide toward you, and tilt up on the Model 2200; on the Model 2100, remove 10 screws)

   You can check your order against the received items.
2. [_] Complete step a or b, depending on the CPU option supplied with your system:
   a. Install the hard disk card. (See *Hard Disk Card Mounting Information* on page 32, for more details.)

      Unpack the hard disk card from shipping smaller box.
      Remove the #4-40 screw from card slot #1. Figure 2-1 shows the location of the hard disk card in the paging terminal.
      Install the hard disk card and secure with the #4-40 screw.

      No formatting is necessary.
   b. Verify that the SCSI disk is mounted in the bottom section of the chassis. (Refer to *SCSI Disk Card Mounting Information (M2200)* on page 32, for more details.)
3. [_] Make sure all circuit cards, in each and every occupied slot, are firmly seated in the paging terminal cabinet.
4. [_] The office computer that operates the paging terminal's database can be connected as a remote connection or a local connection. Depending on whether you are installing a remote connection or a local connection, for the office computer, perform either step a. or b.

**Note** For remote computer connection, the paging terminal is equipped with a US Robotics 56 kbs modem, installed in the slot shown in the paging terminal diagrams. This card allows communication with the computer via a dial-up telephone line. For local computer connection, the paging terminal is equipped with RS-232C serial data capability. This allows communication with the computer via a direct cable link.

a. [_] Plug the RJ-11C modular jack of a telco cable to the top of the modem card into the jack labeled LINE or WALL (do not use the jack labeled PHONE). Connect the other end of the telco cable directly to the telephone wall jack.

b. [_] Connect the supplied Local Serial cable to the serial port (the mounting bracket on the lower backplane.

*Figure 1: Location of Model 2200 Paging Terminal Components*

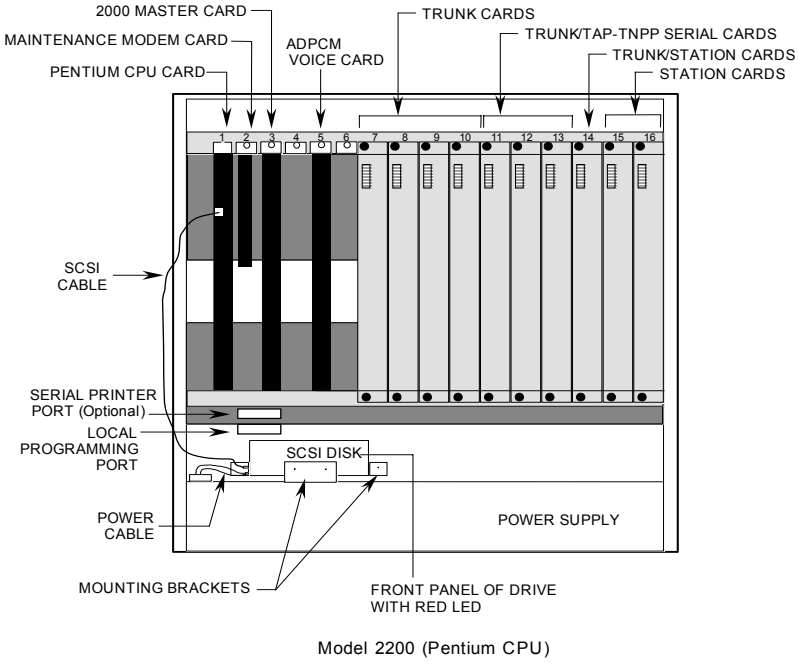
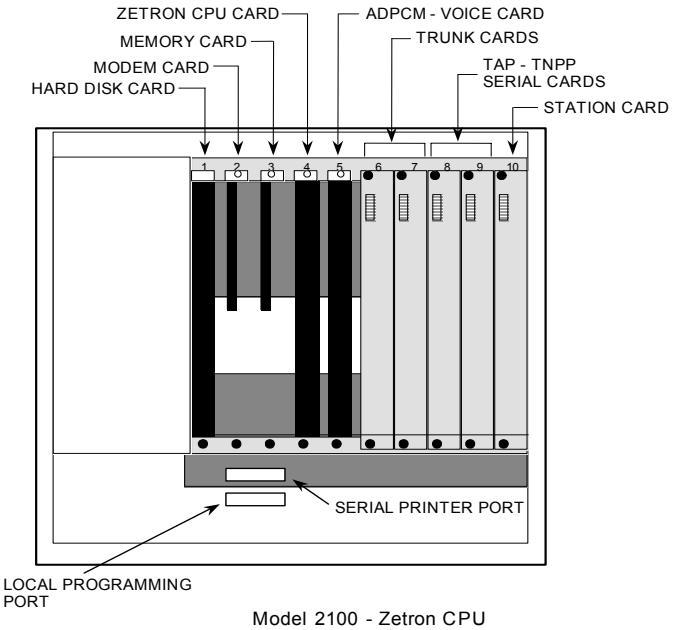



*Figure 2: Location of Model 2100 Paging Terminal Components*



5. [_] Plug the paging terminal unit into the appropriate AC power source and switch on the power. On the Model 2200, the switch is located on the right-side panel; on the Model 2100 the switch is located inside the front door of the cabinet.

> **Note** If an expansion chassis is part of the system, the expansion chassis must be powered up at the same time (or before) the main chassis is powered up.

6. [_] With power applied to the paging terminal, check front panel lights for correct operation as described in *Front Panel Lights* on page 182.
7. [_] At this point, you can connect either the telephone lines designated for the trunk cards of the paging terminal, or a test telephone that connects temporarily for testing purposes.

   Connect the telephone lines, or the test telephone, to the trunk card(s) via the RJ2EX connectors on left side of the lower backplane shown in Figure 3 or Figure 4. Refer to *TELCO Connectors* on page 72 for specific connection information. Refer to the configuration packet you received from Zetron along with the terminal for information on how the telephone trunks were programmed at the factory.

*Figure 3: Model 2200 Telephone and Transmitter Connectors*

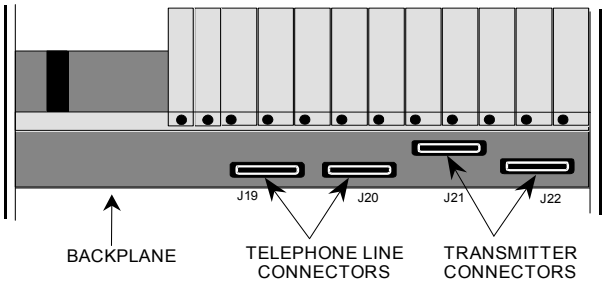
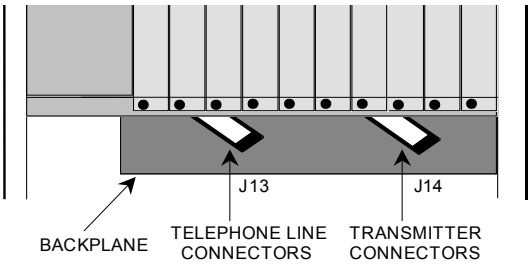



*Figure 4: Model 2100 Telephone and Transmitter Connectors*



8. [_] Connect the transmitter equipment (or test/measurement equipment if the transmitter cannot be connected at this time) to the station card(s) of the paging terminal.

   Connection the transmitter/test equipment to the station card(s) via the connectors on the right side of the lower backplane (see Figure 3 or Figure 4). Refer to *Radio Connectors* on page 98, for specific connection information.

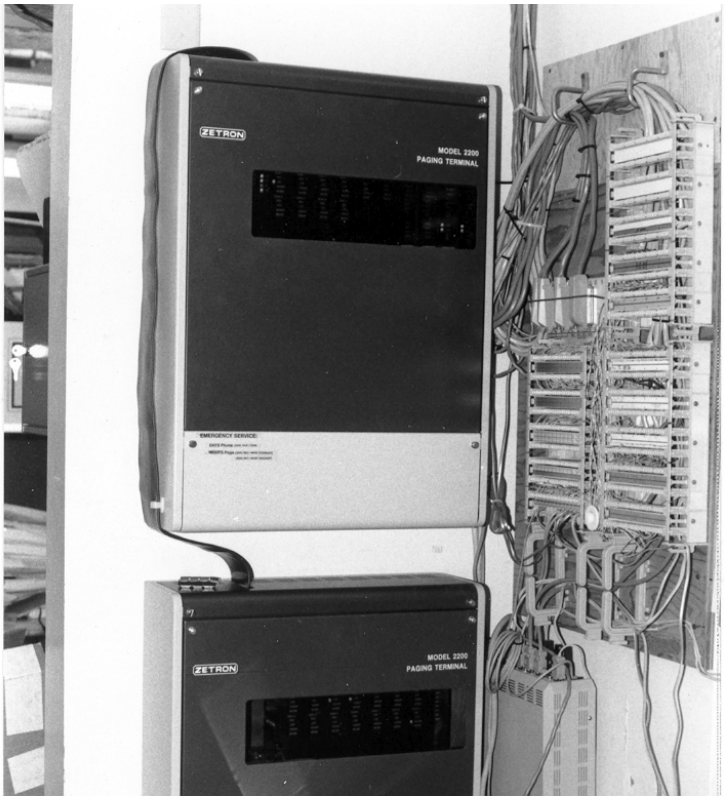
   An amplified speaker can be connected to the XMIT and GND outputs on the front of the Station card for monitoring analog paging in absence of a transmitter.

   **Note** Only tone and voice can be monitored by this method, unless tone remote control is used. Then digital can be heard as modem tones.

9. [_] Install the office computer software; ZbaseW, ZlinkW, etc. Refer to *Installing the Office Software* on page 55. (For more complete information on the ZbaseW program, see the Series 2000 Operation and Programming manual, 025-9034-001.)
10. [_] If you have any trouble linking up to the paging terminal with ZlinkW, refer to the *Troubleshooting the Office Computer* on page 186.
11. [_] To test operation of the paging terminal, it is necessary at this point to create a "test" subscriber database. This database is created by using ZbaseW on your office computer as described in *Installing Office Software* on page 57. (For additional information on the ZbaseW program, see the Series 2000 Operation and Programming manual, 025-9034-001.)
12. [_] Make several test pages and verify pagers activate and audio levels are correct. Note that the telephone trunk circuitry contains AGC circuitry that boosts recorded audio to its maximum. Therefore, do not use the FROM TEL adjustments for audio level adjustment; instead, use the adjustments on the Station card per the next subsection, *Alignment Procedure* on page 30.

    If you experience difficulty getting the system to operate normally, refer to *Troubleshooting and Repair Procedures* on page 179.
13. [_] Mount the paging terminal in its final location (see Figure 5).
    a. For the Model 2200, remove the bottom cover (unscrew, slide toward you, and tilt down). Then remove the hard disk card, and the circuit cards from slots 1, 2, 15, and 16 to gain access to the mounting holes on the back panel of the paging terminal. Refer to *Model 2200 Cabinet Mounting Information* on page 36 for details.
    b. For the Model 2100, attach the mounting brackets to the side panels with hardware supplied. Attach the paging terminal to the wall with lag screws, or to an equipment rack with supplied hardware. Refer to *Model 2100 Cabinet Mounting Information* on page 36 for details.
14. [_] Make all permanent telephone line connections to the RJ2EX connectors on the left side of the backplane and radio transmitter connections to the connectors on the right side of the backplane. Refer to Figure 3 or Figure 4.

*Figure 5: Example of System Installation (including Expansion Unit)*




## Alignment Procedure

The following alignment procedure should be performed on the paging terminal after installation is complete in order to assure correct operation and optimum signal levels.

We recommend that you use the following test equipment:

- a Touch-Tone (DTMF) telephone that can call the paging terminal
- an AC voltmeter
- a communications service monitor
- a 2-tone tone & voice pager tuned for your paging channel

The alignment procedure is provided as a “to do” list (similar to that given for system installation) that will guide you through the steps necessary to align/adjust the paging terminal. Follow the steps in the checklist to install the paging terminal.

1. [_] At the office computer, use ZbaseW to program the subscriber database with a few 2-Tone tone & voice pagers. (For more complete information on the ZbaseW program, see the Series 2000 Operation and Programming manual, 025-9034-001.). For alignment purposes, use the following values for creating a subscriber database:

   2 pagers:
   - Voice Limit = 60 seconds
   - Tone Length = 12 seconds
   - Tone Freq. = 500Hz, 1000Hz
     1000Hz, 2000Hz

   If you are using digital paging, also set up a digital pager.
   Also program a subscriber number for voice prompt access (Status = P).

   Once these test pages are programmed, be sure to update the paging terminal via Comm Update.

2. [_] Trunk adjustments:
   Refer to "Adjustment Procedures" in the Trunk Cards section for details on adjusting the incoming (*From Tel Adjustment* on page 77), outgoing (*To Tel Adjustment* on page 77), and hybrid balance levels (*Hybrid Adjustment* on page 78) on each of your trunk lines. Then return here and proceed to step 3.

   **Note** This balance adjustment will change if you or your telephone company changes any telephone wiring.

3. [_] Station RF deviation adjustments:

   VOICE Audio Adjust:

   a. Call the 2-Tone tone & voice pager. During the voice message time, hold down a key on your Touch-Tone telephone, so you record a long Touch-Tone.

   b. With your service monitor, measure the RF deviation of your radio transmission. While the Touch-Tone key that you recorded is playing, adjust the "XMIT AUDIO" pot on the front of the Station card for about 3.0 - 4.0kHz deviation.

   c. Call the pager again and this time speak during the voice time. While your voice is playing out, check the deviation again to make sure it is about 4.5kHz during the loudest parts.

   TONE Audio Adjust:

   a. Call the first 2-Tone pager (the one with 500 & 1000Hz tones). Hang up after it beeps you for voice, we do not need voice.

   b. With your service monitor, measure the RF deviation of your radio transmission. While the tones (of the 2-Tone pager) are playing, adjust the "XMIT TONE" pot on the front panel of the Station card for 3.5 to 4.0kHz deviation. Check to see if the level varies when it changes from 500 to 1000Hz.

c. Repeat the two preceding steps but use the other test pager with the 1000 & 2000Hz tones. You should find that your channel deviation is independent of tone frequency. Consult Zetron if your modulation is not “flat”.

4. [_] DIGITAL deviation adjustment:

   RF deviation levels on binary digital transmissions are determined by your transmitter, not by the station card.

   To adjust, call a digital pager, and while the digital data is going out, use your service monitor to adjust your transmitter for 4.5 to 5kHz deviation.

## Hard Disk Card Mounting Information

The Zetron hard disk on a card for the Zetron Model 2100/2200 paging terminal is packed separately to avoid damage to the terminal or hard disk during shipment. The hard disk contains all of the software for the paging terminal; therefore, it must be installed before operation of the paging terminal can take place. Installation is simple, but the hard disk can be easily damaged. Please follow the instructions below:

1. Be sure power to the Model 2200/2100 Paging Terminal is turned off.
2. Open the packaging material containing the hard disk. It is a good idea to save the packing materials, including the static-proof jacket, in the event you should ever need to ship your hard disk.

> ⚠ **Caution!** AVOID TOUCHING THE GOLD-PLATED CARD-EDGE FINGERS

3. While holding the hard disk card at the top (card-edge finger side) and bottom, align it with the left-most card guide and the card slot. Check to make sure the gold-plated card-edge fingers are centered over the connector. Now firmly press on the top edge of the hard disk above the connector until it is firmly seated in the connector.
4. Use the #4-40 screw you removed to fasten the hard disk card. Do not operate the paging terminal until the hard disk is firmly fastened.

## SCSI Disk Card Mounting Information (M2200)

The SCSI disk for the Model 2200 Pentium option is packed separately to avoid damage to the terminal or hard disk during shipment. Please follow the instructions below to install the SCSI disk in the Model 2200 (Refer to Figure 1 and Figure 6):

1. Be sure power to the Model 2200 Paging Terminal is turned off.
2. Attach the two supplied brackets to the SCSI disk using the supplied screws.

3. Connect one end of the 50-pin SCSI cable to the SCSI drive with the stripped edge toward the drive's power connector. Connect the other end to connector J1 on the Pentium CPU card (see Figure 6). The stripped edge should be towards pin 1, which means the bottom on the card.
4. Connect the power cable to the mating connector at the left end of the power supply.
5. Fasten the SCSI disk with brackets to the terminal at the location of the pre-drilled holes.

# TELCO Ground Reference

Proper telephone interface operation requires a good ground reference from the chassis of the Model 2100 or 2200 to the Telephone Company ground. You should run a heavy wire (#16 AWG or larger) from one of the lower backplane Z-Bus mounting screws to the telephone demarcation block ground point.

## 48 Vdc Ground Jumper

A jumper on the Z-Bus backplane (702-9071) labeled JP1 selects a floating or positive ground referenced 48-volt telco power supplied by the Zetron equipment. When the jumper is in position A, the positive (+) side of the 48V power supply is connected to chassis ground; in position B, the 48V power supply is floating.

The default setting for this jumper is A, which gives the best results in most installations. However, it may not be desirable to have the jumper in the “A” position when interfacing to distant Central Offices. The slight amount of imbalance on tip and ring can introduce some audio hum, which may be heard on the voice portion of a radio paging message. Consult your Zetron Applications Engineer if you have questions.

*Figure 6: Teknor Brand Pentium CPU Card Layout*

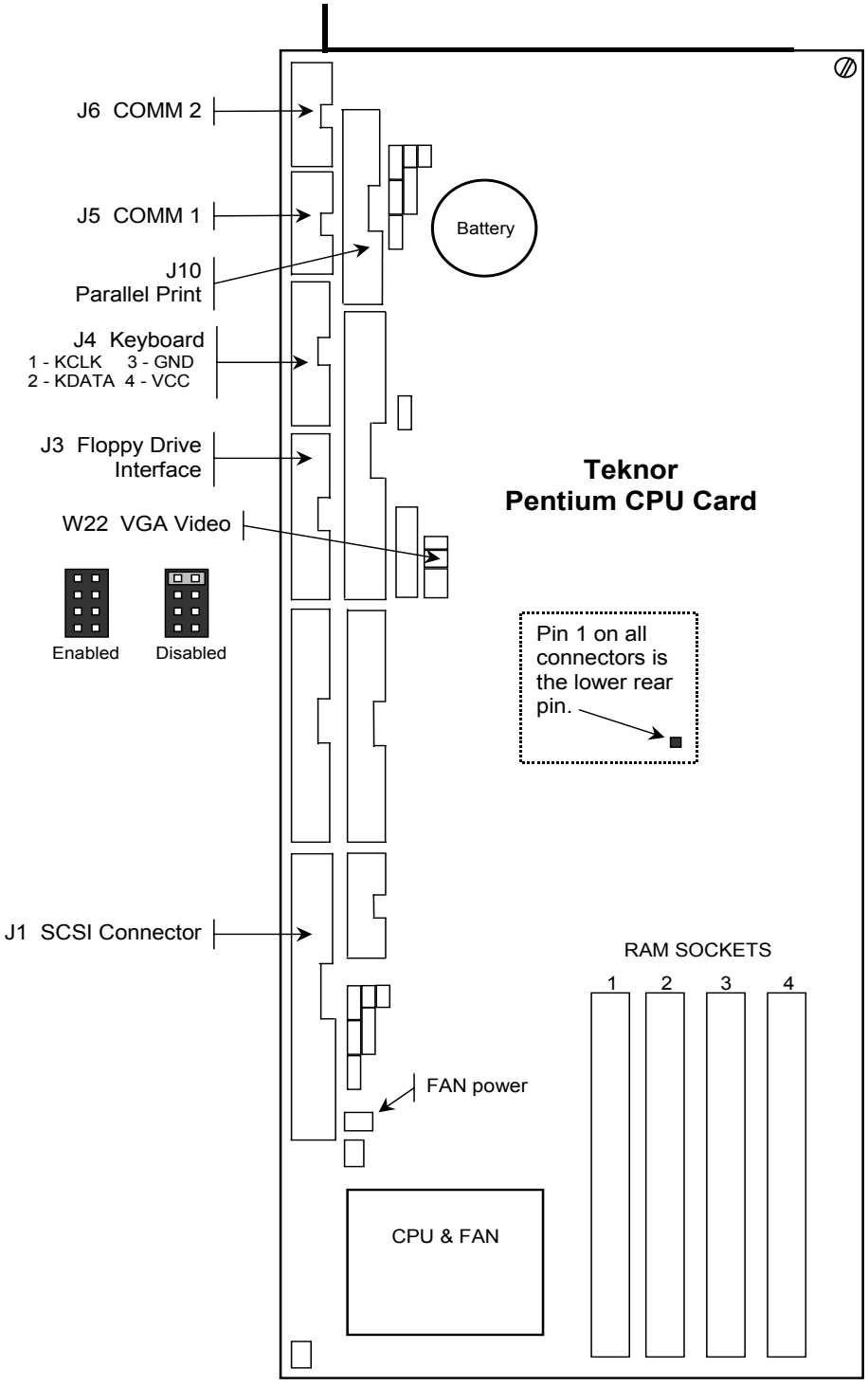
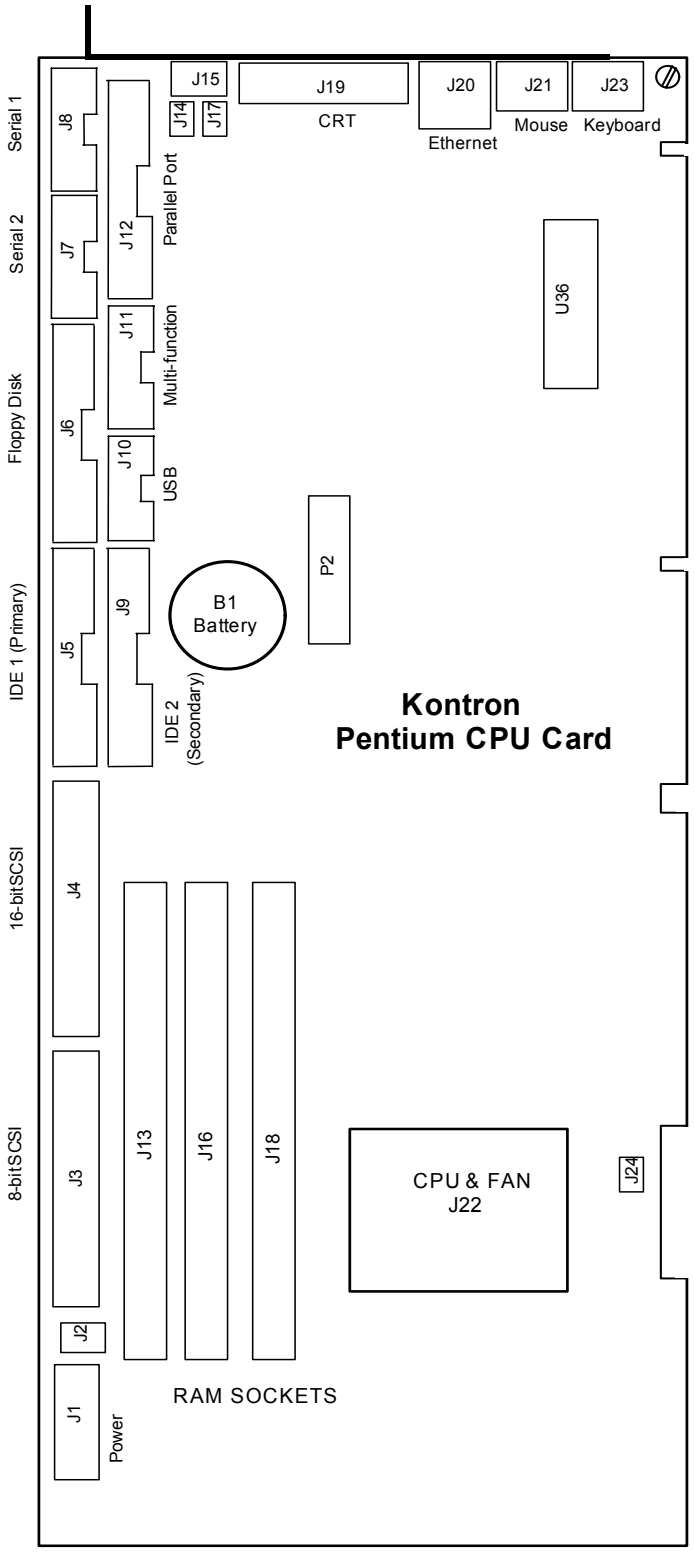


*Figure 7: Kontron Brand Pentium CPU Card Layout*



## Model 2200 Cabinet Mounting Information

Make sure that the Model 2200 is disconnected from its power source. Remove the front door, top cover and bottom cover to reveal the eight 1/4" diameter mounting holes in the back panel along the left and right sides of the cabinet. These holes are used for wall mounting, using wall anchors or lag bolts. See Figure 8.

Wall mounting to a 3/4" plywood backboard (like PABX equipment) is the most common installation method. Eight rubber grommets have been supplied to use as spacers between the Model 2200 rear-panel mounting holes and the plywood mounting surface.

## Model 2100 Cabinet Mounting Information

The Model 2100 can be wall mounted like PABX equipment or rack mounted like radio equipment using the Zetron mounting kit (P/N 950-9128). The mounting kit contains hardware and brackets that bolt to the Model 2100 left and right side panels. Placing the brackets toward the rear of the cabinet gives 1/4" clearance from the surface of a wall (such as 3/4" plywood). Placing the brackets toward the front of the cabinet gives you easy mounting access for standard 19" equipment rack. The Model 2100 requires 12 Units of vertical rack space (20") but only 5.5" of mounting depth.

## Cable Routing

Telephone trunk, radio, and power connections are brought through the right side on the Model 2200 and the bottom rear on the Model 2100, when rack mounted using 50 conductor cables with FEMALE connectors. The 50-pin mating connectors are mounted on the backplane circuit boards, visible below the circuit card cage after the unit's front door has been removed. See Figure 9.

To ground the cabinet chassis to a common earth connection, use any of the screws holding the backplane to the rear panel, or any of the nuts holding the side panels to the power supply shelf.

> ⚠ **Caution!** There are no internal protection devices for lightning strikes; use external protection devices, such as those available from Zetron to protect your equipment investment.

*Figure 8: Model 2200 Mounting Template*

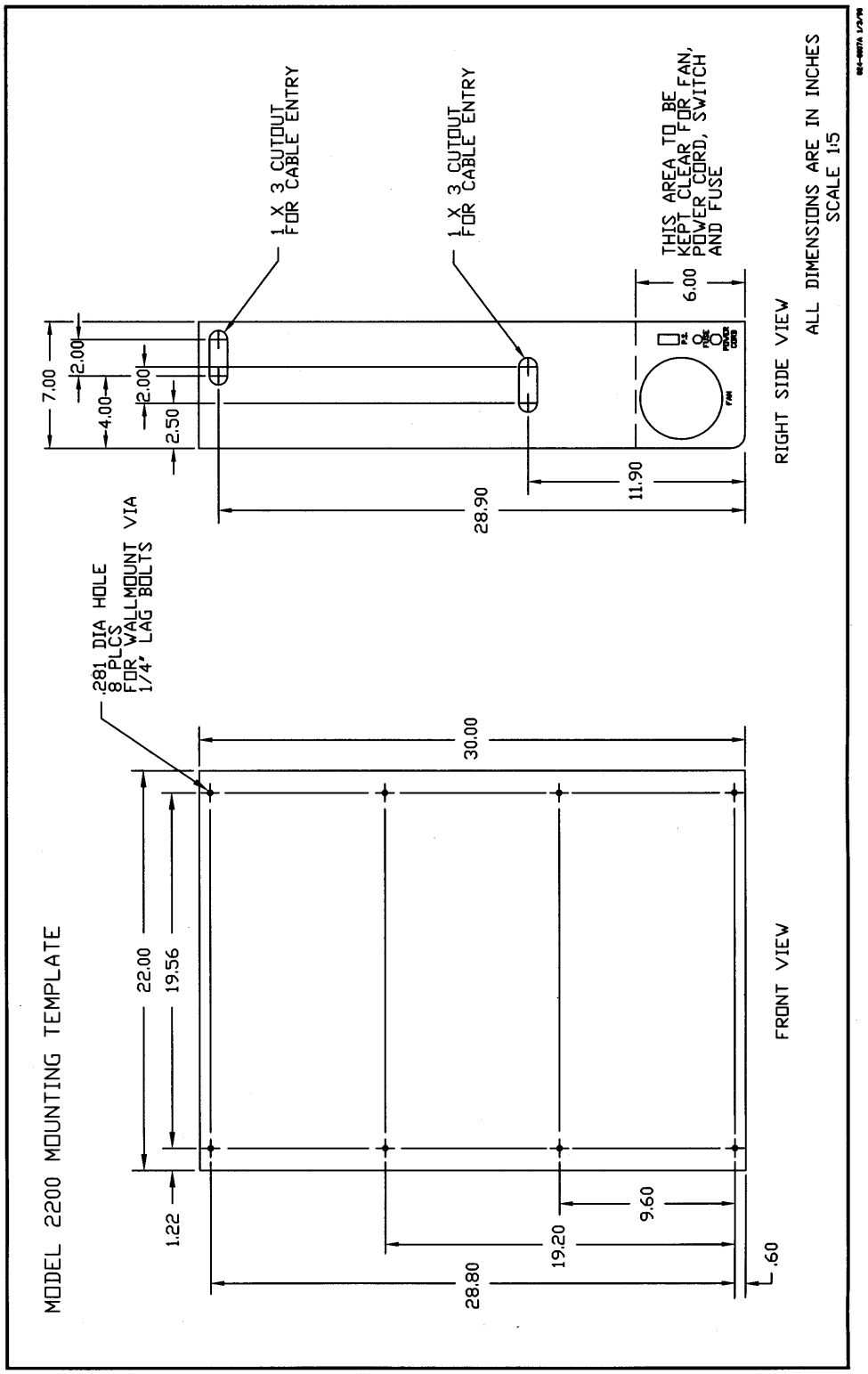
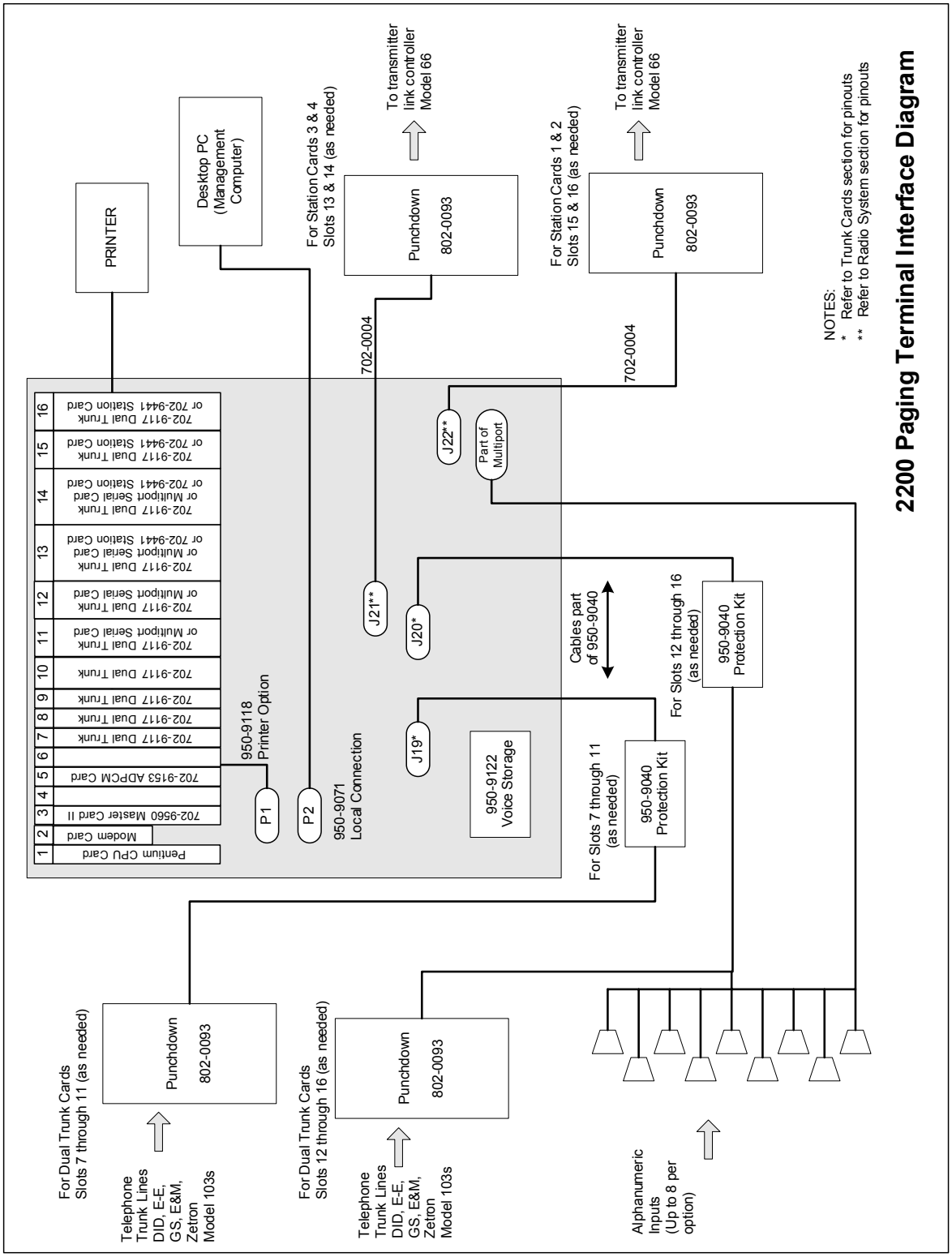


*Figure 9: Model 2200 Interface Diagram*


2200 Paging Terminal Interface Diagram
NOTES:
* Refer to Trunk Cards section for pinouts
** Refer to Radio System section for pinouts
PRINTER
Desktop PC (Management Computer)
For Station Cards 3 & 4 Slots 13 & 14 (as needed)
To transmitter link controller Model 66
Punchdown 802-0093
For Station Cards 1 & 2 Slots 15 & 16 (as needed)
To transmitter link controller Model 66
Punchdown 802-0093
702-0004
702-0004
J22**
Part of Multiport
J21**
J20*
J19*
Cables part of 950-9040
For Slots 12 through 16 (as needed)
950-9040 Protection Kit
For Slots 7 through 11 (as needed)
950-9040 Protection Kit
950-9122 Voice Storage
950-9118 Printer Option
P1
P2
950-9071 Local Connection
1 Pentium CPU Card
2 Modem Card
3 702-9560 Master Card II
4
5 702-9153 ADPCM Card
6
7 702-9117 Dual Trunk
8 702-9117 Dual Trunk
9 702-9117 Dual Trunk
10 702-9117 Dual Trunk
11 702-9117 Dual Trunk or Multiport Serial Card
12 702-9117 Dual Trunk or Multiport Serial Card
13 702-9117 Dual Trunk or Multiport Serial Card or 702-9441 Station Card
14 702-9117 Dual Trunk or Multiport Serial Card or 702-9441 Station Card
15 702-9117 Dual Trunk or 702-9441 Station Card
16 702-9117 Dual Trunk or 702-9441 Station Card
For Dual Trunk Cards Slots 7 through 11 (as needed)
Telephone Trunk Lines DID, E-E, GS, E&M, Zetron Model 103s
Punchdown 802-0093
For Dual Trunk Cards Slots 12 through 16 (as needed)
Telephone Trunk Lines DID, E-E, GS, E&M, Zetron Model 103s
Punchdown 802-0093
Alphanumeric Inputs (Up to 8 per option)

# Model 2200EX Installation

## General

*PLEASE READ BEFORE STARTING THE INSTALLATION*

Installing the Model 2200EX will require approximately 15 minutes of down time on an existing Model 2200. The required tools are a small Phillips screwdriver and a #6 nutdriver. The location of Model 2200EX components is shown in Figure 10.

**Note** The 2200EX installation requires the use of either the Zetron CPU card (702-9176) or the Pentium CPU card (950-9633 / 950-0688).

If you have purchased new telephone or transmitter interface cards with your 2200EX, you may need to contact Zetron Technical Support to have your system files updated to support the new cards. You should have this done before starting on the hardware installation. Please call Zetron Technical Support (at 425-820-6363) and ask for Series 2000 Paging Terminal support (at extension 490).

Due to changes in design of the Model 2200 “main chassis”, there are two different types of Model 2200EX slotted top covers. If your chassis requires an older style top cover, you should have received one of that type with your kit. If you did not receive the correct cover, please call Zetron Technical Support (at 425-820-6363) and notify us of the oversight. The correct cover will be sent to you.

- New Style Cover: Attaches with nine pan head screws.
- Old Style Cover: Attaches with two large thumbscrews, in front only

You should have received the following with your Model 2200EX kit:

| QTY | Description |
|---|---|
| 1 | Model 2200 Chassis |
| 2 | 702-9204 EXPAND Cards (1 labeled “MASTER”, 1 labeled “SLAVE”) |
| 1 | Model 2200EX Interface Cable |
| 1 | Model 2200 Front Door |
| 2 | Slotted Top/Bottom Covers |
| 6 | Lag Bolts |
| 6 | Grommets |
| 1 | AC Power Cord |
| 1 | Old Style Slotted Top/Bottom (only if required to match older chassis) |

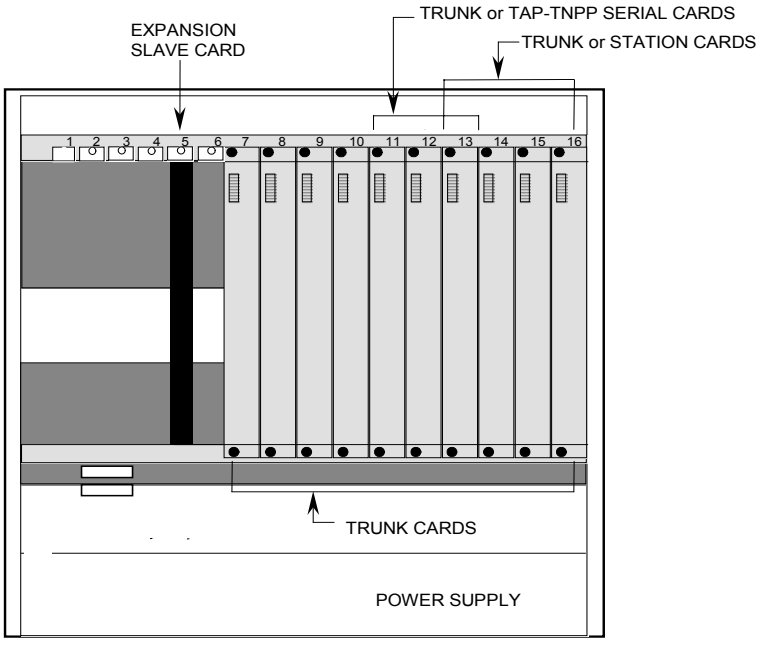
## Model 2200EX Setup

### ♦ Setting up a Model 2200EX

1. Remove the front door of the 2200EX and remove all cards from the chassis. Using the lag bolts and grommets provided in the kit, mount the 2200EX chassis to the wall. Be careful to mount the chassis close enough to the 2200 main chassis that the interface cable provided can connect the two units. Ensure that the lag bolts hit studs in the wall to ensure a solid mounting for the new chassis.
2. Remove the top panel of the 2200EX chassis.
3. Verify that the SLAVE Expand card is configured as follows:

   JP2 = Out
   JP8 = Out
   JP3 through JP7 = IN
   JP1 = SNG/SLV position
4. Install the SLAVE Expand card in slot 5 of the 2200EX chassis.
5. Connect the "DUAL" connector end of the 2200EX chassis interface cable to the SLAVE Expand card's 68-pin female connector, labeled J2. This connector is located at the top edge of the Expand card. Tighten the thumbscrews until the cable connector is fully seated against the card connector.
6. Route the interface cable through the cutout in the top cover and replace the top cover on the 2200EX chassis.
7. Install the new trunk/multiport/station cards in the 2200EX chassis. (See Figure 10)

*Figure 10: Possible Locations for Model 2200EX Components*


EXPANSION
SLAVE CARD
TRUNK or TAP-TNPP SERIAL CARDS
TRUNK or STATION CARDS
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16
TRUNK CARDS
POWER SUPPLY

Model 2200 Expansion Chassis

## Model 2200 Main Chassis Setup

### ♦ Setting up a Model 2200 Main Chassis

1. Remove power from the 2200 main chassis.
2. Remove the top panel of the 2200 main chassis.
3. Verify that the "MASTER" Expand card is configured as follows:

   JP2 = In
   JP3 through JP8 = Out
   JP1 = DUAL/MST position
4. Install the MASTER Expand card into slot 5 of the main chassis (slot 6 if it is an older type chassis). The Expand card needs to be in slot 5 (or 6) to allow the interface cable to exit through the top cover. You may need to move your ADPCM and/or 2000 CPU card in order to make room for the Expand card. The ADPCM and CPU cards will both work correctly in any slot 4 through 6.
5. Connect the "SINGLE" connector end of the interface cable to the Expand card's 68-pin female connector, labeled J2. This connector is located at the top edge of the Expand card. Tighten the thumbscrews until the cable connector is fully seated against the card connector.
6. Remove the main chassis top cover and replace it with the slotted cover supplied in the upgrade kit. Route the interface cable through the cutout in the top cover before securing the cover to the chassis.

## Power Up Test

### ♦ Checking for proper power up indications

**Note** You must install both the Expand card and at least one trunk or station card in order to provide minimum loading for the power supply. Failure to provide minimum loading for the power supply will produce unpredictable results.

1. Switch on power to the 2200EX chassis and verify the following indications:

| | |
|---|---|
| SLAVE Expand Card | Slave LED = ON<br>All Power Supply LEDs = ON |
| Trunk and Station Cards | T1 and T2 both ON, and T3 blinking slowly on most cards. Some cards may not look like this, however, that should change once the main chassis is powered up and sends the 2200EX chassis a master reset. |

2. Switch on power to the main chassis and verify the following:

| | |
|---|---|
| 2200 Main Chassis | MASTER LED = ON<br>All power supply LEDs = ON<br>RD/WR LEDs = Flashing |

| | |
|---|---|
| 2200EX Chassis | WR LED = Blinking<br>RD LED = Flashes as the cards load |

3. Verify that all trunk, multiport, and station cards on both the main and 2200EX chassis have both SELECT and T1 through Tn LEDs flashing quickly.

At this point, you should be able to proceed with interfacing the new cards in the expansion chassis to their respective equipment. If you experience any difficulty, please contact Zetron Technical Support (at 425-820-6363) for assistance.

# 2000 Series Printer Option

## ZCPU Serial Printer Port

The 2000 Series Printer Option (Part No. 950-9118) lets you connect a serial printer to a 2000 Series terminal for real-time printing of paging traffic. This option is only used with a Zetron CPU card.

Your printer must have a serial interface. This option package does not use the more common parallel printer interface. Your serial interface needs to be set up as follows:

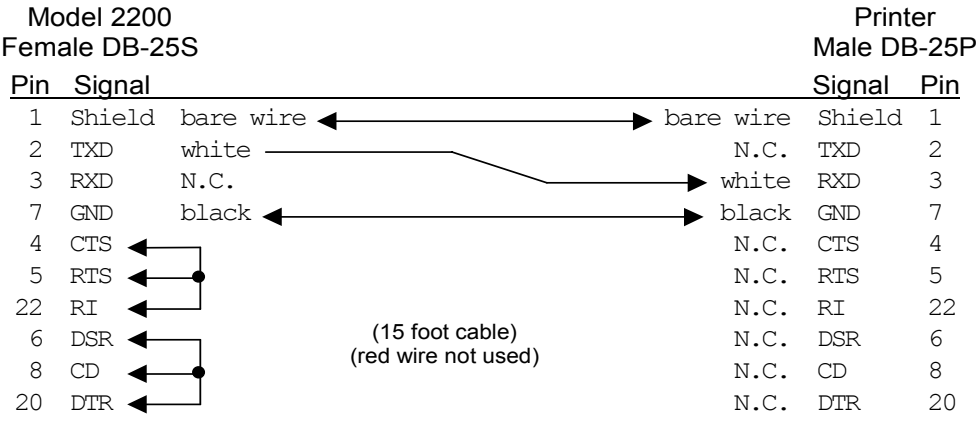
| | | |
|---|---|---|
| 4800 | baud rate | (software-settable, see *PrinterPost* on page 272) |
| 8 | bits | |
| No | parity | |
| 1 | stop bit | (2 stop bits usually work OK) |

The cable (Part No. 709-7085) that we supply is wired as shown in the wiring diagram below. It works for most printers, for instance an Epson printer with an Epson 8145 serial interface option card.

The cable is plugged into the connector mounted on the lower backplane (on a bracket on current machines). It should be labeled “PRINTER”.

**Note** There is no need for the printer or the printer cable to be hooked up to the paging terminal. The status of the printer does not matter to the terminal. The printer can run out of paper, jam, go off-line, or be turned off - none of this will affect the paging terminal. So, be sure to check it as needed for enough paper and that it has not jammed.

*Figure 11: Printer Cable Wiring Diagram*




### Pentium CPU Card Parallel Printer Ports

When a 2200 paging terminal is equipped with the Pentium CPU card, the default printer output is via the parallel port on the CPU card, connector J10 (see Figure 6 on page 34). This is normally cabled to a DB-25 connector mounted on the terminal's hard drive bracket in the bottom of the main chassis.

Earlier versions of the 2200 paging terminal provided only a serial port output for printer activity. Many system operators have used this for other purposes than driving a printer. One example would be logging the serial output to a text file on a PC. This provides a record of every transaction or error occurring on the system.

There is only one supported way to convert the existing parallel printer output of the Pentium CPU card into a serial output. You can purchase an after-market parallel-to-serial data convertor and connect it between the parallel port of the paging terminal and whatever serial device you are sending the printer port output to.

## Configuring the Digi One™ SP Option

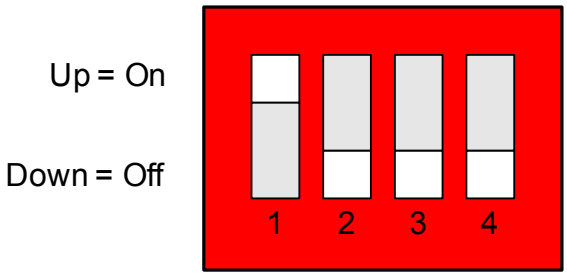
The configuration of the Digi One™ SP serial/IP conversion module is accomplished through the Ethernet port on the device. The configuration takes place in two phases. The first phase is carried out using a software tool provided by Digi International on CD-ROM. It will require that the unit is connected to the network while being configured. The second phase is carried out with the browser installed on your PC (such as Internet Explorer). You simply enter the IP address of the module you want to work on into the browser address bar manually.

## Confirming the Serial Port Pinout

**Warning!** It is important that the switch be set correctly since the functions of the various pins change depending on how it is set. Actual damage to equipment can occur if the serial cable is plugged in while the switch is set to the wrong serial port type.

The Digi One SP module is capable of supporting three different serial port standards. They are EIA-232 (same as RS-232), EIA-422/485 Full-Duplex, and EIA-485 Half Duplex. Which type of serial port is being supported is set using a small, red, 4-position DIP switch on the bottom of the module near the end with the serial port D-connector. In this application, the switch will always be set to support an EIA-232 serial port.

*Figure 12: Digi One™ SP Serial Port Switch set to EIA-232*




When the switch is configured as shown in Figure 12 (that is switch 1 up and switches 2, 3, and 4 down), the module is set for EIA-232 and the D-connector will have the pinout shown in Table 1.

*Table 1: Pinout of the Digi One™ SP configured for EIA 232*

| DB-9 Pin | EIA-232 Signal |
|---|---|
| 1 | DCD |
| 2 | RXD |
| 3 | TXD |
| 4 | DTR |
| 5 | GND |
| 6 | DSR |
| 7 | RTS |
| 8 | CTS |
| 9 | RI |
| Shell | GND |

## Initial Configuration Using the Digi Software Tool

The first phase of software configuration for the Digi One SP module is carried out using a configuration software tool provided with the units on CD-ROM by Digi International. Before starting this procedure you will need to obtain a permanent IP address from the IT department responsible for the network that the paging terminal will be installed on.

**Note** In any actual installation, the fixed IP address used for the serial/IP module must be assigned by the IT department with responsibility for the network on which the link is being installed.

The configuration of the Digi One SP module can be programmed on a different network than the one it will eventually be installed in (like the network in your shop) as long as the IP address assigned is also available on that network. If this is not the case, then you will have to perform this work "on-site". Fortunately, the steps do not take very long and almost any PC connected to the network will have adequate resources to carry out the task. (Runs Windows 2000 or Windows XP and has a CD-ROM drive)

**Note** If you try to assign an IP address to the Digi unit which is not valid on the network that the configuration PC is part of, the Digi will refuse to accept the configuration. Make sure that the IP address of your PC and the IP address assigned to the Digi are compatible.

For the purposes of the following example, the IP address was chosen assuming a network numbered 10.0.1.22 and a subnet mask of 255.255.255.0. Table 2 gives the rest of the settings that will be used for the serial/IP module.

**Note** These IP settings may very well not work on your network.

*Table 2: Initial Programming for the Digi One SP Module*

| Parameter | Digi One Module Setting |
|---|---|
| IP | 10.0.1.22 |
| subnet | 255.255.255.0 |
| gateway | 10.0.1.1 |
| DNS server | [none] |
| Domain | [none] |
| Host name | [none] |
| Scenario | Incoming Network Connection |

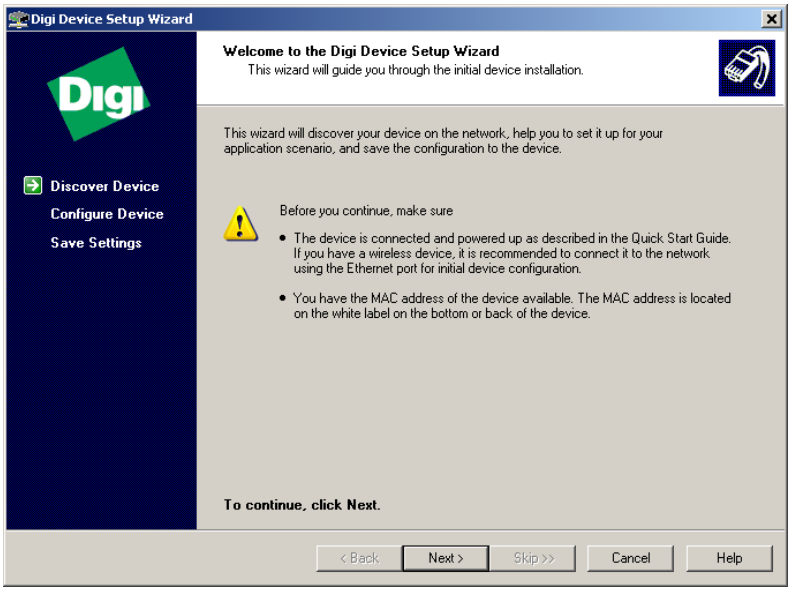
### ♦ Connecting the Digi One SP to the network

1. Remove the module from its packing and confirm that its DIP switch is set to EIA-232 (see page 44).
2. Locate the MAC address printed on the bottom line of the factory label on Digi One SP module. Write this number down because you will need it during the initial setup. (It is labeled “MA: xxxx:xxxx”.)
3. Install the loopback device supplied with the unit on the serial port D-connector of the Digi One SP.
4. Plug the power supply into the module and then into a wall socket. Do not expect the power LED to come on right away.
5. Plug the Ethernet cable into the RJ-45 jack on the module and plug the other end of the cable into any available port on the network. This must be the same network that serves the PC you intend to use for configuring the module and in which the module will be used. The port used does not need to be the port to which the module will finally end up connected.

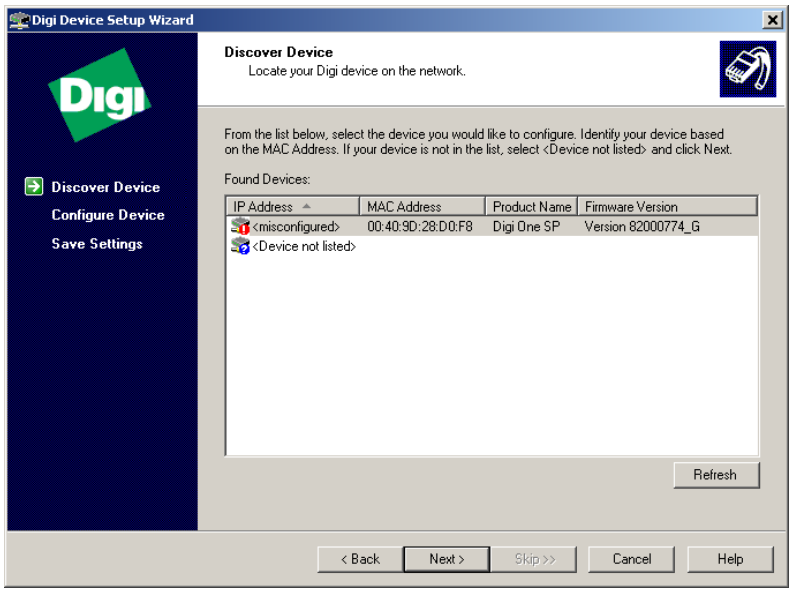
The Power and Link LEDs should both be on at this point.

### ♦ Performing the initial configuration using the Digi software tool

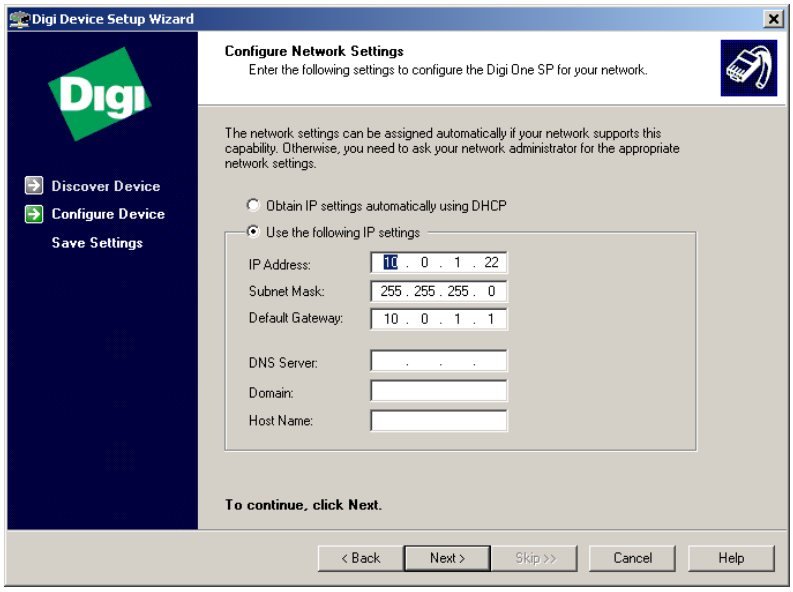
1. Insert the CD-ROM into the disk drive and close the drive. If the top screen for the utilities does not start automatically, use the **RUN** option on the **START** menu.
2. From the opening screen, select the Digi Device Setup Wizard. The opening screen of the wizard will look like the following. Click **Next**.


Digi Device Setup Wizard
Digi
Discover Device
Configure Device
Save Settings
Welcome to the Digi Device Setup Wizard
This wizard will guide you through the initial device installation.
This wizard will discover your device on the network, help you to set it up for your application scenario, and save the configuration to the device.
Before you continue, make sure
The device is connected and powered up as described in the Quick Start Guide. If you have a wireless device, it is recommended to connect it to the network using the Ethernet port for initial device configuration.
You have the MAC address of the device available. The MAC address is located on the white label on the bottom or back of the device.
To continue, click Next.
< Back
Next >
Skip >>
Cancel
Help

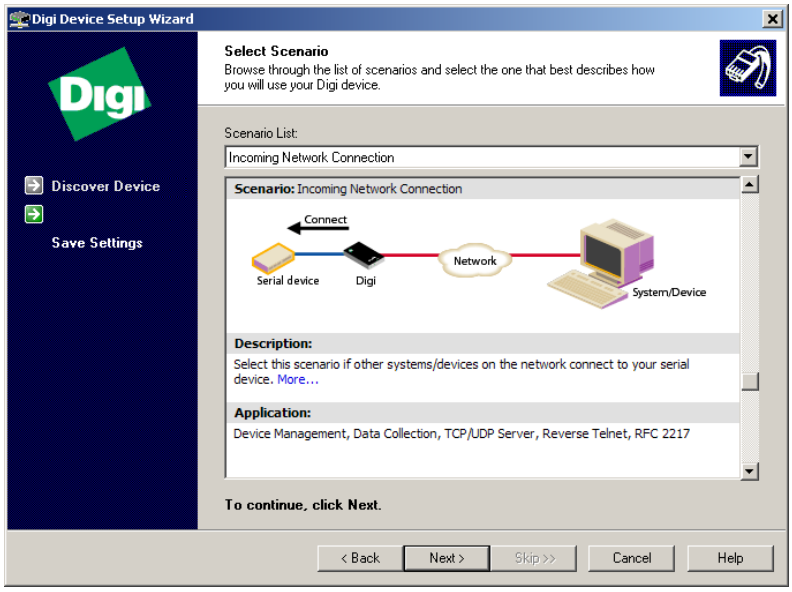
3. Once the software has scanned the network available to it, it will display the IP and MAC addresses of any Digi One units it finds. Select the MAC address for the unit you are configuring and then click on **Next**.



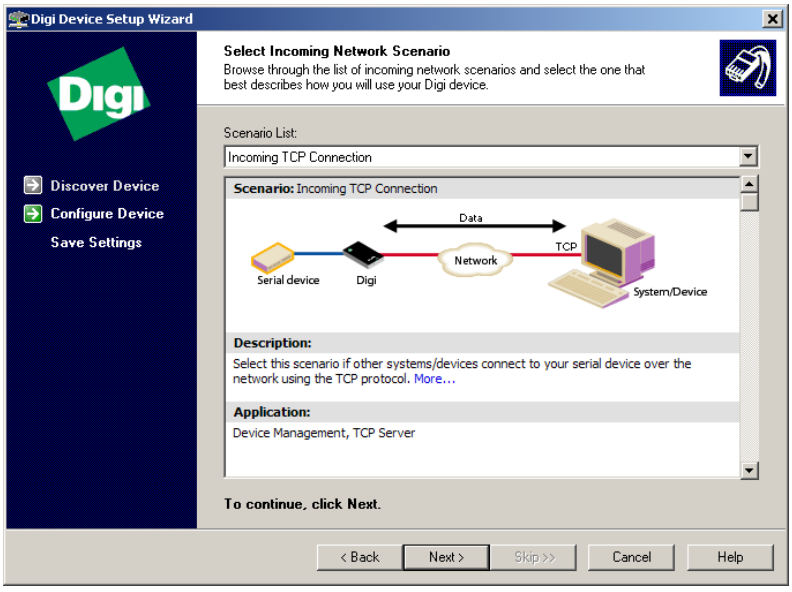

4. When the following screen appears, select the manual IP radio button and fill in the boxes for IP Address, Subnet Mask, and Default Gateway. In the following example, these have been filled in with the settings from Table 2. Please note that the boxes for DNS Server, Domain, and Host Name should still be blank. When you are finished, click on **Next**.


Digi Device Setup Wizard
Configure Network Settings
Enter the following settings to configure the Digi One SP for your network.
Discover Device
Configure Device
Save Settings
The network settings can be assigned automatically if your network supports this capability. Otherwise, you need to ask your network administrator for the appropriate network settings.
Obtain IP settings automatically using DHCP
Use the following IP settings
IP Address: 10 . 0 . 1 . 22
Subnet Mask: 255 . 255 . 255 . 0
Default Gateway: 10 . 0 . 1 . 1
DNS Server:
Domain:
Host Name:
To continue, click Next.
< Back
Next >
Skip >>
Cancel
Help

5. When the Select Scenario screen is displayed, use the **Scenario List** box or the scroll bar on the right of the window to move through the list and select **Incoming Network Connection** as the scenario type. Click on **Next**.

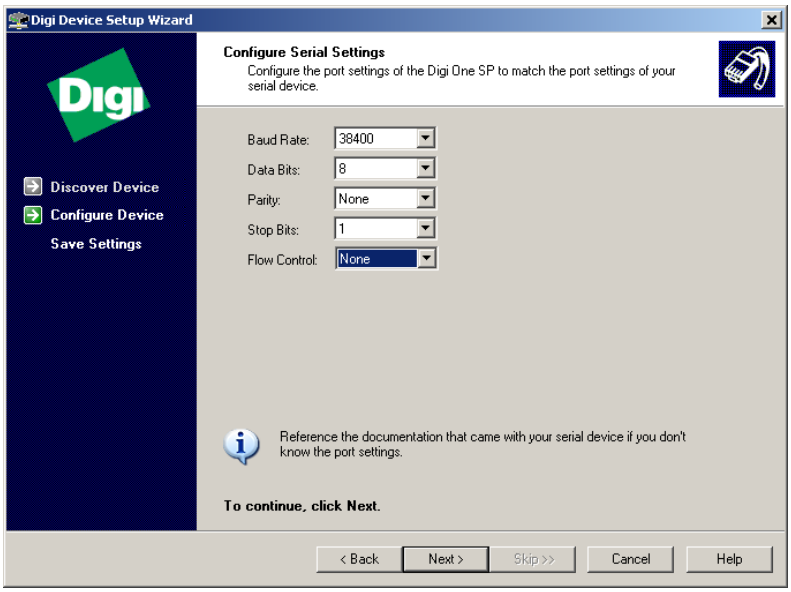



6. After selecting Incoming Network Connection as a scenario, you are prompted in the following screen to pick a more specific scenario. Open the **Scenario List** box and select **Incoming TCP Connection** as the scenario type. Click on **Next**.

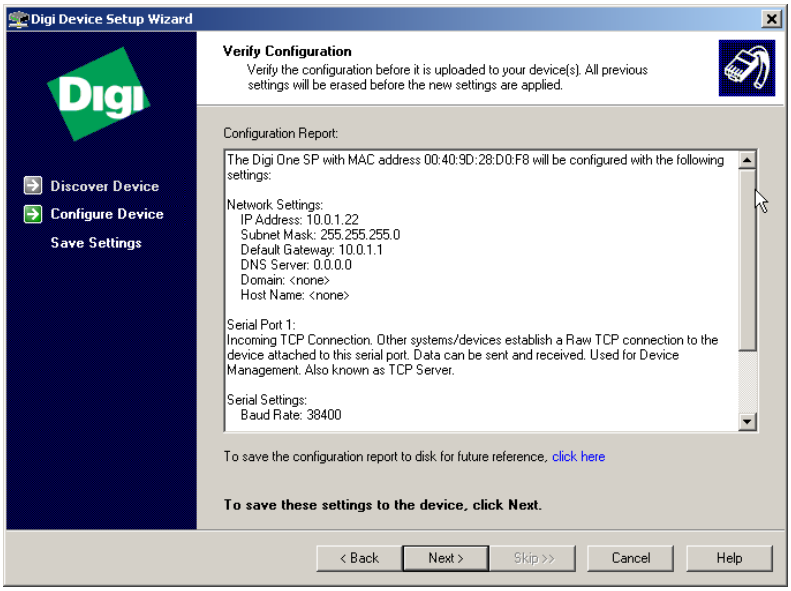


7. When the following screen is displayed, configure the serial port parameters as follows, then click on **Next**.

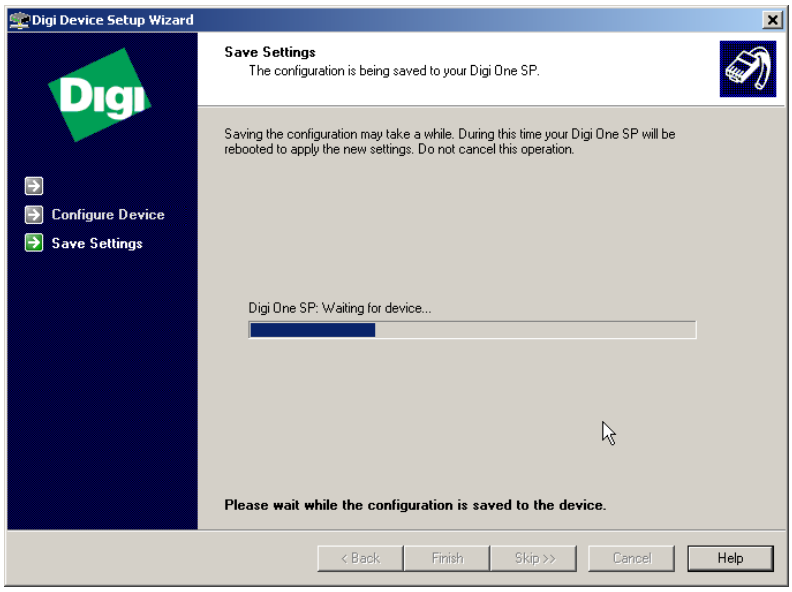
   Data Rate = 38,400 Data Bits = 8
   Parity = None Stop Bits = 1
   Flow Control = None


Digi Device Setup Wizard
Digi
Discover Device
Configure Device
Save Settings
Configure Serial Settings
Configure the port settings of the Digi One SP to match the port settings of your serial device.
Baud Rate: 38400
Data Bits: 8
Parity: None
Stop Bits: 1
Flow Control: None
Reference the documentation that came with your serial device if you don't know the port settings.
To continue, click Next.
< Back
Next >
Skip >>
Cancel
Help

8. After you finish selecting and setting up the scenario, the wizard will display a screen that allows you to scroll through the settings you have entered for the module to confirm that they were correctly entered. If you wish, you can save a copy of this report to your hard drive. When you finish your review, click on **Next**.


Digi Device Setup Wizard
Digi
Discover Device
Configure Device
Save Settings
Verify Configuration
Verify the configuration before it is uploaded to your device(s). All previous settings will be erased before the new settings are applied.
Configuration Report:
The Digi One SP with MAC address 00:40:9D:28:D0:F8 will be configured with the following settings:
Network Settings:
IP Address: 10.0.1.22
Subnet Mask: 255.255.255.0
Default Gateway: 10.0.1.1
DNS Server: 0.0.0.0
Domain: <none>
Host Name: <none>
Serial Port 1:
Incoming TCP Connection. Other systems/devices establish a Raw TCP connection to the device attached to this serial port. Data can be sent and received. Used for Device Management. Also known as TCP Server.
Serial Settings:
Baud Rate: 38400
To save the configuration report to disk for future reference, click here
To save these settings to the device, click Next.
< Back
Next >
Skip >>
Cancel
Help

9. The following screen is displayed while the program saves the new settings to the Digi One SP module. This process will take several minutes and the status bar will reach the right side long before it is over. Be patient. You do not need to do anything until the process is finished. The program will advance to the next screen automatically.


Digi Device Setup Wizard
Save Settings
The configuration is being saved to your Digi One SP.
Digi
Saving the configuration may take a while. During this time your Digi One SP will be rebooted to apply the new settings. Do not cancel this operation.
Configure Device
Save Settings
Digi One SP: Waiting for device...
Please wait while the configuration is saved to the device.
< Back
Finish
Skip >>
Cancel
Help

10. The final screen confirms that you have successfully configured the Digi One SP module to perform as a Incoming TCP Connection. Review the check boxes at the bottom of the screen, select the ones you want or clear them all, and click on **FINISH**.

The remaining programming to configure the modules will be accomplished by connecting to each module directly by means of an ordinary browser.

## Configuration Using a Browser

The final configuration of the Digi One module used to communicate with the paging terminal is accomplished by logging onto the unit with a common Internet browser and making the necessary changes. The easiest time to do this is right after you finish the first phase of the module configuration using the tool provided by Digi International on CD-ROM, while the module is still connected to the network.

For the purposes of this example, we will still be using the IP address information initially presented in Table 2. The serial port settings for the unit is listed in Table 7.

*Table 3: Browser configuration of the Digi One™ SP Module*

| Parameter | Digi One Setting |
|---|---|
| login user | root |
| login password | dbps |
| NETWORK | no change |
| SERIAL PORT<br>Basic Serial Settings:<br><br>Advanced Serial Settings:<br>require user to login<br>Verbose connection<br>(click "APPLY") | <br>No Change<br><br><br>No<br>No |

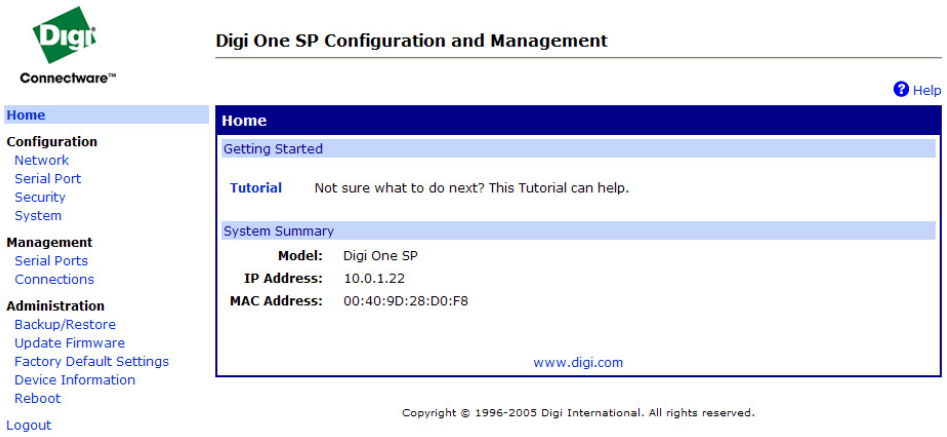
A re-boot of each DIGI device is required after these configuration changes.

♦ **Programming the Digi One SP module with your Internet browser.**

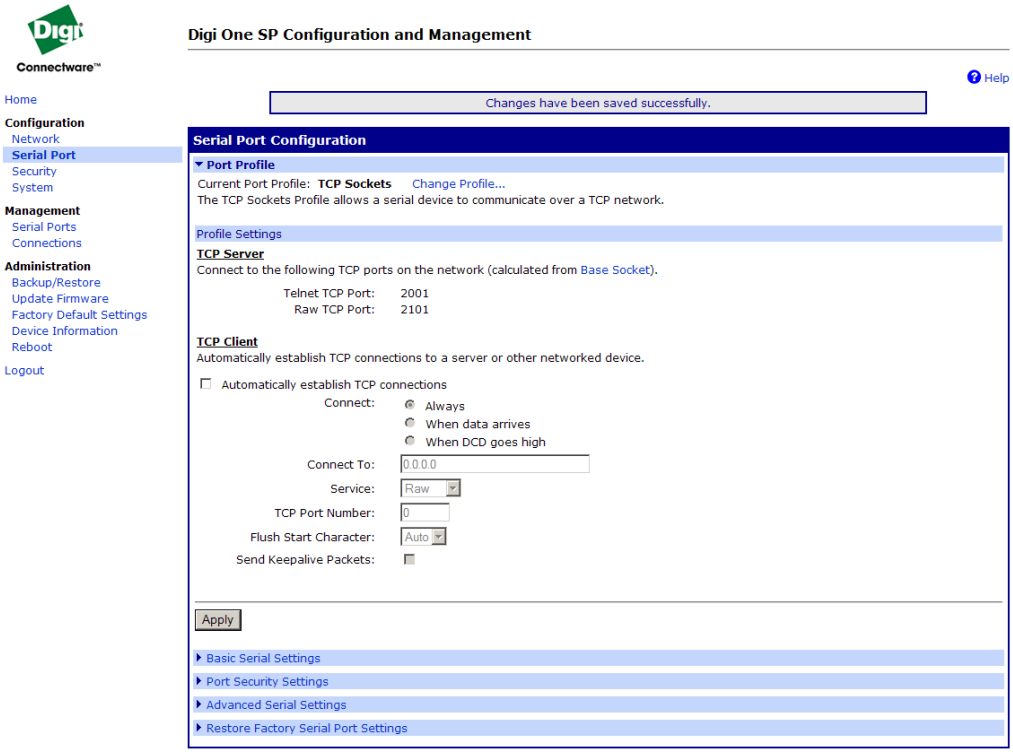
1. After opening your browser, manually enter the address of the Digi One SP module into the address bar. In our example this would be "10.0.1.22". Press **ENTER** and the log on dialog box that follows should appear.

Connect to 10.0.1.22
The server 10.0.1.22 at Digi One SP requires a username and password.
Warning: This server is requesting that your username and password be sent in an insecure manner (basic authentication without a secure connection).
User name:
root
Password:
Remember my password
OK
Cancel

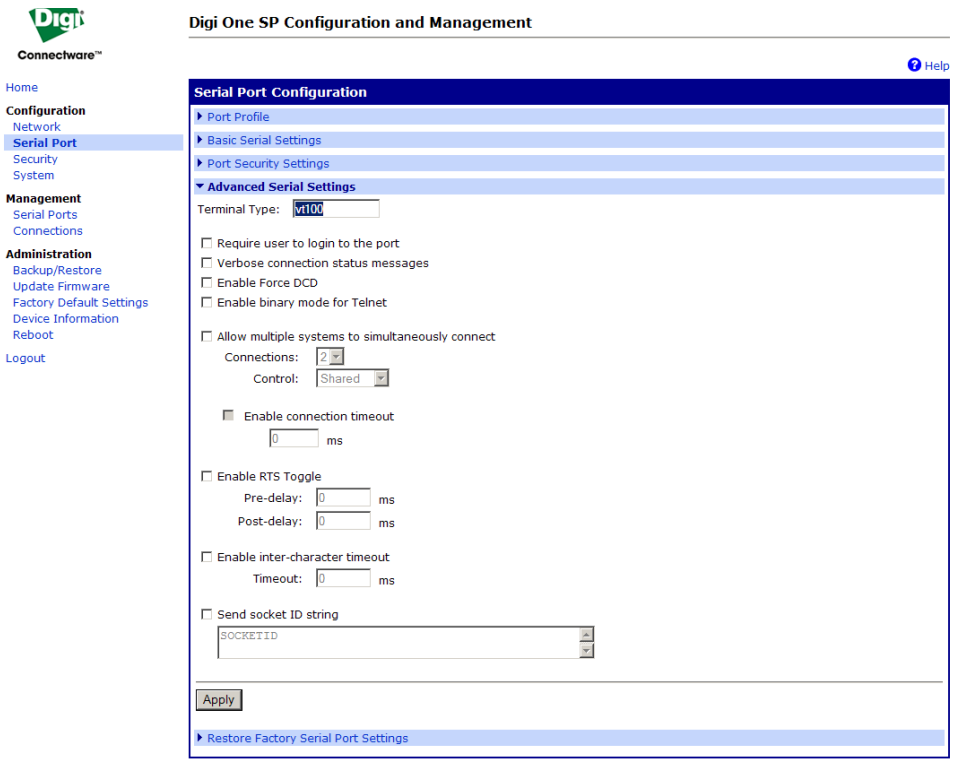
2. Enter the default user name (**root**) and password (**dbps**) into the appropriate boxes in the dialog and click on the **OK** button. The Home screen for the module should appear. The screens we need to open can be accessed by clicking on the options found in the column on the left of the screen, under the heading **Configuration**.




3. Click on the option **Serial Port**. This opens the **Serial Port Configuration** window. We will not be changing any settings in this opening screen. Notice the **Basic** and **Advanced** options that appear in the bottom of the window. Record the **Raw TCP Port** number; you will need it later on when directing ZlinkW and ZbaseW to the Digi One SP module over the network.



4. Click on the option **Advanced Serial Settings**. As shown in the following window, configure the serial port parameters to match the settings listed in Table 3. When you have finished, be sure to click on the **Apply** button before you leave this window, otherwise none of the changes will be stored in the module.




5. This concludes the programming of the module. It must be rebooted before being placed in service. You can do this by clicking on **Reboot** in the left column, or by disconnecting the unit from the network and removing power from it.

   If you choose to reboot the module later, select **Logout** from the column on the left and close your browser.

Remove the loopback device from the serial connector on the Digi one SP module and use the supplied serial cable to connect the serial port on the module to the local programming port on the paging terminal.

# Installing the Office Software

## Overview

This section discusses the connection of the office computer to the paging terminal. It also describes the software (programs) that accompany the paging terminal. Later in the section, a simple procedure is also given to load the software as well as start and exit the database program. Subscriber database management is performed on an IBM PC compatible office computer located either local to or remotely from the 2000 Series Paging Terminal. For remote connection, the paging terminal is equipped with a 9600-baud modem to communicate by dial up telephone. For local connection, an RS-232C cable is supplied for communication at 9600 baud. All paging terminals are equipped with the modem to enable Zetron to remotely service your Paging Terminal.

An intelligent database program, ZbaseW, provides operators with the ability to easily change subscriber settings through forms oriented screens with fill in the blanks fields. Built in help information prompts the operator with the valid settings for each data field. When the changes are complete, they are transferred from the office computer to the paging terminal via telephone link or local link, using an operation called ZlinkW.

## Office Computer Specification Guidelines

The 2000 Series Paging Terminals require the use of a personal computer on an ongoing basis. Our ZbaseW software package will be run on the computer to maintain your pager/ subscriber database.

Using the following guidelines, your computer dealer should be able to provide you with a system and any additional items you may need. If you already have a computer, you can check to make sure it meets the specifications.

## Specifications

| PC Feature | Guidelines |
|---|---|
| Computer | Any IBM-compatible personal computer, ZbaseW and ZlinkW do not care whether the processor is genuine Intel® of one of the competing brands |
| CPU Speed | 500 MHz or faster |
| Memory | 256 MB minimum, more is better |
| Hard Disk | The final number will depend on the options covered by your license, assume minimum values of:<br>10 MB of free disk space to load ZbaseW<br>5 MB of disk space for each 1000 users in database |
| CD-ROM/Floppy Drive | Requires a CD-ROM drive for installing the ZbaseW software<br>3.5 inch floppy drive is entirely optional |
| Display | Requires a video card and monitor capable of providing a resolution of 1024 x 768 or higher |
| Operating System | Microsoft Windows XP® with SP2,<br>Windows Server 2003® with SP1 or later |
| Database Engine | Microsoft Access 2007 Runtime |
| Modem | Optional depending on where PC is located relative to the Series 2000 paging terminal, internal modem prefered |
| Serial Port | A standard RS-232 serial port is not required unless you are using a local connection to the Series 2000 paging terminal or an external modem. Since serial ports are no longer standard equipment on personal computers, you may need to purchase an aftermarket card to provide one. |

## Dialup Modem Connection to Paging Terminal

To install the modem telephone line connection at the paging terminal, remove the front panel and top cover of the 2000 Series paging terminal. Plug a telco cable with RJ-11C modular jack into the modem card in Slot 2. The jack you should use is labeled either **LINE** or **WALL** (do not use the jack labeled **PHONE**). Connect the other end of the telephone cable directly to the telephone company supplied wall jack. The modem card has a built in speaker for call progress monitoring.

## Local Office Computer

To install the optional local RS-232C computer connection, attach the RS-232C cable between the DB-25P port labeled LOCAL on the lower left of the lower backplane, and the serial port of your office computer. Refer to *CPU Card (702-9176)* on page 151 for information on cable routing, pinouts, and maximum distance between the office computer and the paging terminal.

# Installing Office Software

The steps for installing the ZbaseW software should be familiar to anyone that has installed a software package on their PC within the last few years. The installation of ZbaseW or ZlinkW can chosen idepenently from the opening window of the installer.

**Note** Remember that you will need to have Administrative priviledges in order to install software on the PC.

### ♦ Installing ZbaseW on a PC

1. Insert the software CD into the CD-ROM drive on your PC.
2. If the installation routine does not load automatically, use the **RUN** option on the **Start** menu to manually launch the "**setup.exe**" executable on the CD.
3. In the window that appears, select the installation option for ZbaseW.
4. Follow the instructions provided by the installer.
5. When the installation is complete, remove the CD from the PC CD-ROM drive and store it in a safe location.

### ♦ Installing ZlinkW on a PC

1. Insert the software CD into the CD-ROM drive on your PC.
2. If the installation routine does not load automatically, use the **RUN** option on the **Start** menu to manually launch the "**setup.exe**" executable on the CD.
3. In the window that appears, select the installation option for ZlinkW.
4. Follow the instructions provided by the installer.
5. When the installation is complete, remove the CD from the PC CD-ROM drive and store it in a safe location.

# Installing ZbaseW for Multiple Users on a Network

Before going on to the installation procedure, we will take a moment to clearly state a few important points concerning the use of ZbaseW with multple users.

- The term "multiple users" is intended to mean multiple PCs running ZbaseW and having access to a common Ethernet network. It does *not* refer to multiple users logging on to a single PC.
- The multiple user operation requires the use of an Ethernet network, no other method of connecting the PCs involved is currently supported.

- Each PC involved has a complete installation of the ZbaseW and ZlinkW programs on its hard drive. The only files missing are shared data files, which will exist on only a single server in the network.

A folder must be set up on one PC on the shared network (probably a server, but not necessarilly a server) that can be accessed by all of the PCs that will be used to manage the paging terminal. This folder will hold the one copy of the database file that all of the PCs running ZbaseW will access. There are two additional files that may also appear in this folder depending what is going on in the system. The files are:

| File Name | Description |
|---|---|
| ZbaseW_be.accdb | This file is the database file for all of ZbaseW. This file should be backed-up on a daily basis. |
| ZbaseW_be.laccdb | This is a lock file created by Access program. It is used by Access to keep track of record locking in the database file. |
| zlinksem.txt | This file is unique to ZlinkWbeing used in a multiuser scenareo. The file is created and removed by the ZbaseW program whenever a user is using ZlinkW from his or her PC. It serves as a flag to other user when they try to start ZlinkW from within ZbaseW. The PC checks this folder for this file and dennies access to the user trying to log on to the paging terminal. |

**Tip** If a user has ZlinkW up and in use when his or her computer dies, the copy of zlinksem.txt is left on the PC. This will prevent anyone else from using ZlinkW from within ZbaseW until this file is removed.

The folder `C:\ZbaseW` on each PC should contain all of the other files that would normally be found on a single user system machine.

## Installing ZbaseW on the First PC

♦ **ZbaseW for the first of several PCs:**

1. Perform the normal installation, following the instructions from the CD-ROM. Remember that you need Administrator priviledges in order to install software.
2. When the installation is finished, remove the CD-ROM disk and store it in a secure place.
3. Open the `C:\ZbaseW` directory and move the database file `ZbaseW_be.accdb` to the network directory that is going to be shared by all of the PCs running ZbaseW.
4. Start the ZbaseW program and select the **Special** tab.
5. From the Special tab, click on the **Change Where the Database File is Found** button and follow the instructions given to point this instance of ZbaseW at the network location for the database file.

Do not allow anyone to copy the `ZbaseW_be.accdb` file back into the `C:\ZbaseW` folder in the future. If the ZbaseW program finds that file in its root folder, it will start to behave like a single-user instance ZbaseW.

### Installing ZbaseW on Subsequent PCs

♦ **ZbaseW for additional PCs:**

1. Perform the normal installation, following the instructions from the CD-ROM. Remember that you need Administrator priviledges in order to install software.
2. When the installation is finished, remove the CD-ROM disk and store it in a secure place.
3. Open the `C:\ZbaseW` directory and delete the database file `ZbaseW_be.accdb`.
4. Start the ZbaseW program and select the **Special** tab.
5. From the Special tab, click on the **Change Where the Database File is Found** button and follow the instructions given to point this instance of ZbaseW at the network location for the database file.

Do not allow anyone to copy the `ZbaseW_be.accdb` file back into the `C:\ZbaseW` folder in the future. If the ZbaseW program finds that file in its root folder, it will start to behave like a single-user instance ZbaseW.

## Starting ZbaseW

Once installed, ZbaseW can be started from either the icon it placed on the PC desktop or from the Windows **Start** menu.

After loading itself, ZbaseW displays its top window. From this window you can select various parts of the ZbaseW database to edit or access the ZlinkW communications utility to exchange information with the 2000 Series paging terminal. The following table lists the tabbed windows and function buttons found in ZbaseW.

| Tab | Function Buttons |
|---|---|
| Edit | Subscribers, Groups, Canned Messages, Active Call Counts, Rollover Call Counts, Locations |
| View | Subscribers, Subscriber Data Tables, Groups, Canned Messages, Active Call Counts, Rollover Call Counts, Locations |
| Print | Subscribers, Groups, Canned Messages, Active Call Counts, Rollover Call Counts, Locations |
| ASCII | Import Subscribers, Export Subscribers, Import Groups, Export Groups, Import Canned Messages, Export Canned Messages, Export Active Call Counts, Export Rollover Call Counts |

| Tab | Function Buttons |
|---|---|
| Communications | Update Paging Terminal, Import Active Call Counts, Rollover Call Counts and Import, Check Last Rollover Time, ZlinkW |
| Traffic/Stats | View Current Traffic, Import Statistics, View Previously Imported Statistics, Print Previously Imported Statistics |
| Special | Send a Page, Swap Pagers, Halt Service for a Subscriber, Change Where the Database is Found, Full Rebuild |
| Info | License Agreement, Version and Copyright Information |

# ZbaseW Communications (ZlinkW)

Now that the office computer software is installed, you need to configure the software for communications with the paging terminal. You should at this point already have the hardware in place to communicate from the office computer to the Paging Terminal (see pages 26 and 191 for details). If you do not, come back to this section when you do. For detailed instructions on operating ZbaseW to change subscriber settings and transfer them from the office computer to the paging terminal please refer to the 2000 Series Operating & Programming Manual (025-9034).

To configure the communications software you need to edit the locations settings for your particular type of communications link, telephone number, and other similar information related to each specific paging terminal location.

### ♦ Editing a Location

1. Click the **Edit** button on the ZbaseW Main menu.
2. In the Edit menu, click the **Locations** button.
3. In the Locations Records window that opens, click on the **New** button and then fill in the information for **Site Name**, **Password** (optional), **Phone** number. and **Port**.
4. When you have finished entering the information for a site, click on the **Next** button.
5. Click on the **Close** button to return to the Main menu.

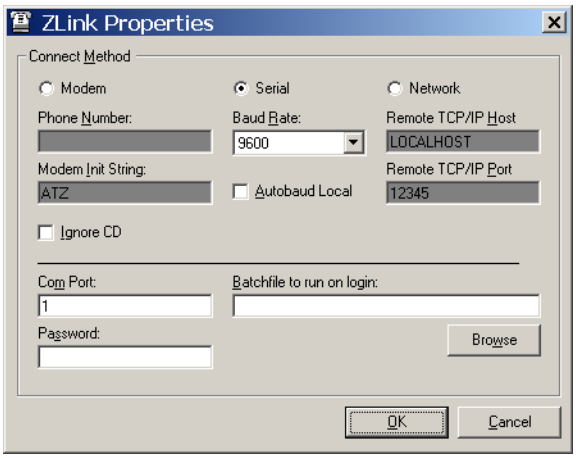
| Parameter | Description |
|---|---|
| Site Name | The Site Name is just a reminder name for the site at which the paging terminal is located. The name will be shown each time you link up to the paging terminal. If you do not have multiple sites, you may just leave it blank. |

| Parameter | Description |
|---|---|
| Password | The Password allows for maximum security of your paging terminal data. A person intent on gaining unauthorized access to your paging terminal would need to know your paging terminal's phone number & password, plus have a copy of ZlinkW. The password is entered here and automatically used by ZbaseW when it transfers data to and from the paging terminal. This means you do not need to memorize it. |
| Phone Number | The Phone Number field is used to input the phone number (complete dialing string actually) for modem connections, specify baud rate for local connections, and to supply the IP address and port number for network connections. More details on local and IP settings can be found under *Local Connections* on page 64. |
| Com Port | The COM port field is used to identify which COM port on the PC is being used for the local serial or modem connection. This will most often be set either "1" or "2". When this field is selected, the HELP window will contain additional information about what your options are. |

After you have created the first location you need to configure the communications properties in ZlinkW. The following procedure demonstrates how to do that.

### ♦ Setting ZlinkW communications properties

1. From the ZlinkW menu bar, select the Communications menu.
2. From the Communications menu, select the **Properties** option. The ZlinkW Properties dialog will open.
3. In the ZlinkW Properties dialog, select one of the three option buttons across the top to specify the mode of communications being used: **Modem**, **Serial**, or **Network**. The dialog will disable some of the fields in the window based on the mode of communication you select.




4. Fill out the remaining fields to support the communications mode selected in the preceding step.

5. Click on the OK button to save the settings exit this dialog.

## ZlinkW Property Fields

What follows is a brief description of the fields in the ZlinkW Properties dialog box.

### Modem

This mode of operation assumes that both the PC running ZlinkW and the paging terminal have modems attached to them. You will need to supply the phone number of the modem attached to the paging terminal and any necessary initialization string for the modem attached to the PC.

### Serial

This mode of operation assumes a straight serial connection between the PC and the paging terminal. You will need to specify the baud rate for the connection and the COM port being used.

### Network

This mode of operation assumes that there is a IP-Network-to-Serial Port adapter attached to the serial port of the paging terminal. You will have to supply the IP address of the adapter attached to the serial port on the paging terminal and the port number being used by that adapter for raw TCP data.

### Phone Number

This field is for the phone number that the modem attached to the computer must dial in order to reach the modem attached to the paging terminal. The phone number can be prefixed with a “Bxxxx” to set the baud rate the modem is set to prior to the CONNECT string occurring. (See *Local Connections* on page 64 for a list of the 4-digit baud rate settings.) Alternatively, the phone number can be prefixed with “Dxxxx” to set the baud rate the modem is set to for the entire session.

If ZlinkW has been invoked from within ZbaseW for network-based communications, you will see a string with the format Nxxx.xxx.xxx.xxx:ppppp displayed in the Phone Number field. See *Network Connections* on page 64 for more information on what this means.

### Baud Rate

This field sets the baud rate used for the serial port in the Serial mode. Use the arrow on the right to open the drop-down list and select the desired baud rate.

### Remote TCP/IP Host

This field is used for the Network mode of communication. Enter the IP address for the network-to-serial converter attached to the paging terminal. For example: 169.254.4.229

### Modem Init String

This field is used to enter a modem initialization string if it is necessary to configure the modem to something other than its default settings.

### Autobaud Local

This check box modifies the behavior of a local serial connection. It has no effect on a modem connection. Checking this box allows the computer to try other baud rates if it does not establish a connection using the baud rate selected in the baud rate field. It will try all of the available baud rates until it makes a connection with the paging terminal. If the baud rate originally specified was correct, then checking this box will have no affect on operation.

### Remote TCP/IP Port

This field is for specifying the IP port number to be used at the network-to-serial adapter attached to the paging terminal. The port number will be supplied by the software configuration tool that came with the adapter when you set the IP address.

### Ignore CD

This item works with the Modem mode. If this box is checked, the modem will not disconnect automatically on loss of carrier.

### Com Port

This field is used with both the Modem and the Serial modes of operation to specify the PC serial port used for the communications link.

### Batch file to run on login

This field specifies a batch file for the PC to execute after it logs on to the paging terminal. It is best that you do not attempt to enter anything here from ZlinkW. If you last ran ZlinkW as part of a ZbaseW or MCU command, you will find a batch file listed here.

### Password

This field holds a password to be used by the PC to log on to the paging terminal. If you know the correct password, you can enter it in this field. If you have made a connection from within ZbaseW, then this field will already hold whatever password you used last.

## Modem Connections

If a modem is being used (internal or external connected to a serial port on the PC), you simply type the telephone number to be dialed into the Phone Number field. You do not have to hyphenate the number; however, you may do so to make it more readable if you prefer. The ZlinkW will ignore the hyphens.

If you require any special dialing features in order to place an outside call through your office telephone system, consult the documentation for your modem and add the necessary characters to the dialing string.

If no prefix is added, ZbaseW defaults to behavior consistent with a prefix of "B5760" (connect at 57,600 baud and then shift baud rate after connection if necessary). If other behavior is required, a different prefix should be added.

### Local Connections

The letter "**L**" is used to indicate that a direct local connection is being used; from the serial port on the PC to the serial port on the paging terminal. If no additional information is provided in the dialing string, the default baud rate of 4800 will be used. An entry in the format of "**Bxxxx**" is used to set the baud rate used for the connection. The string "**xxxx**" is a 4-digit number for the baud rate.

| | |
|---|---|
| **B0300** = 300 baud | **B1440** = 14,400 baud |
| **B1200** = 1200 baud | **B1920** = 19,200 baud |
| **B2400** = 2400 baud | **B2880** = 28,800 baud |
| **B4800** = 4800 baud | **B3840** = 38,400 baud |
| **B9600** = 9600 baud | |

The string for specifying the baud rate and indicating that a local serial connection is in use can be entered in two ways. You could type "B3840L" or you can type "L3840". Both strings are interpreted the same way by ZlinkW.

### Network Connections

The letter "**N**" is used in the Phone Number field to indicate that a network connection is being used. The "**N**" is followed by the IP address of the paging terminal and the port number being used on the network-to-serial port adapter attached to it. The address and port number are separated by a colon. For example, the following string indicates the connection is a network connection to IP address 169.254.4.229 through port 2101.

```
N169.254.4.229:2101
```

## Exiting ZbaseW

Use the following general procedure to exit ZbaseW.

♦ **Exiting ZbaseW**

1. Save your changes and close any submenu windows that are open and return to the main window.
2. If you have made any changes to the database, you should update the database in the paging terminal before you shut down ZbaseW. If you attempt to exit the

program before doing so, ZbaseW will ask you to confirm that this is really what you want to do.

3. Return to the main window in ZbaseW and click the close button located in the upper right corner.

# Backups

Please establish good backup systems and procedures from the very beginning. If you have spent several days setting up your pager customers, you probably do not want to do it again. Making backup files is the only reasonable way to avoid this.

Refer to the 2000 Series Operations & Programming Manual (025-9034), Subscriber Database section, for tips on setting up backups.

## Changing ZlinkW Passwords

If you have multiple paging terminals in ZbaseW Locations, you need to be careful about changing ZlinkW passwords (the Password field in ZbaseW Locations). (The most likely normal reason to have multiple paging terminals set up is if you have a "hot backup" paging terminal.)

The reason that you must follow the correct procedure when updating passwords is that changing the password in ZbaseW or ZlinkW only changes the password on the PC running the software. In order to avoid locking yourself out of the paging terminal, you need to force the Series 2000 machine to update its database record for the password as well.

### ♦ Updating the password on multiple paging terminals

1. Start the ZbaseW software.
2. Select the **Comm** tab and click on the **ZlinkW** button.
3. After ZlinkW establishes communications with the paging terminal and is waiting for your action (the cursor is blinking at the "+" prompt), press the **ESC** key on the PC keyboard (this establishes the correct "zlink.pw" password for this site on the PC).
4. Select the **Edit** tab in the ZbaseW window and click on the **Locations** button.
5. In the Location window, change the password for the paging terminal to which you are linked. Close the window by clicking the close button in the upper right corner.
6. Select the **Comm** tab and click on the **ZlinkW** button. (ZlinkW logs on with the password from "zlink.pw", sees that password is OK, sees that it is different than the current password recorded in Locations, so then does "pword p" with the new password.)

Repeat this procedure for each paging terminal on which you need to change the pass word.

If you do not follow the preceding procedure, and change more than one password at a time, or do not link up first, then at least one terminal will fail to link up the next time you access it.

If you have locked yourself out of the paging terminal, set Dip Switch 1 on the CPU in the paging terminal to the “A” position to bypass the password and let you in; then set the switch back to the normal “B” position.

**Note** If you are posting to multiple paging terminals, as you link up to each one, you will normally see "access denied" on the first "pword l" line, then "access granted" on the second "pword l" line. This is normal.

## Office Computer Operations Guidelines

These guidelines cover operational considerations in using your PC with a 2000 Series Paging Terminal.

### Shared PC

The computer that you use with our ZbaseW software need not be dedicated to our use. Our software basically runs like any other package - you start it up, do what you want, then get out of it. Just like your word processor, spreadsheet, or telecommunications program.

You can use the PC to watch your paging traffic in real time. We have found that some people like to leave their PC in this mode all the time (especially if they have purchased the Local Connect option). If this is something you think you might be doing, note that it precludes any other use of the PC while watching the traffic.

### Linking to the Paging Terminal

Each 2000 Series Paging terminal has a maintenance port or ports. These maintenance ports are used for such functions as updating subscribers, watching traffic, getting call counts, performing diagnostics, and so forth. These ports cannot be used to initiate paging, alpha paging, or for any other use.

You can link up between your computer and the paging terminal maintenance ports in one of three ways:

- Modem connection
  A modem in your PC calls the modem in your paging terminal.
- Serial connection (Local Connect)
  A serial port in your computer is cabled directly to a serial port in the paging terminal.
- IP Network connection
  An after-market network-to-serial convertor is attached to the maintenance port on the paging terminal. When the location information for the site is entered in ZbaseW/ZlinkW, the IP address and port number for the convertor is entered in place of a phone number or serial baud rate.

These maintenance connections are discussed in detail in the following subtopics.

### Maintenance Port

Regardless of the method normally used by the system operator to link up to the terminal, the technical support personnel at Zetron need a maintenance telephone line into the modem maintenance port of the terminal. This is particularly true during initial installation so we can configure the terminal for you; and later for answering questions, running diagnostics, and sending software updates.

This telephone line is completely separate from any telephone lines used for routing paging calls into our trunk cards. The maintenance line is an ordinary subscriber line, like your home telephone or a FAX line. Be sure the line *does not* have a Call Waiting feature. If someone called that number while you (or we) were linked up to the terminal, the momentary interruption of audio would drop the line, possibly causing problems.

It is best if this telephone line is completely dedicated to this use. If the paging terminal is not in your office, the telephone line must be dedicated, unless you have some kind of automatic or remote-controlled telephone switch.

If the paging terminal is in an office, you can share the telephone line with another device, such as a desk set or a FAX line. If you use a FAX line, you will need a switch to select either the paging terminal or the FAX. This means that each time someone needs to link up to the paging terminal via modem, the line will need to be switched over (and then switched back when done).

This “shared-line” situation usually works reasonably well if you use Local Connect, otherwise it is usually too inconvenient for personnel in the office. If it is shared with a desk telephone, people tend to pick up the line instead of letting the paging terminal answer it. (Our default setting is to answer after two rings).

Overall, it simpler and more reliable if you can dedicate an ordinary telephone line to the terminal for maintenance purposes.

### PC Modem Connection

If you decide to use a modem installed on your office PC to communicate with the paging terminal via its maintenance port, this will require a second telephone line for paging

operations. One line is used by your computer modem, and the other goes into a modem card in the paging terminal (the maintenance line discussed in the previous subtopic).

If the terminal and computer are physically near each other, you should consider whether or not want to use Local Connect.

The line used by your computer modem does not need to be a dedicated line. For example, in many offices you could share the line that goes to the telephone on your desk with the modem in your computer. Be aware that in this case, while you are linked up to the paging terminal, nobody will be able to call you. The line *must not* have Call Waiting, since the beeps or clicks used to indicate an incoming call are known to interfere with modem operations.

Some people use one of their low-use business lines for the computer modem line. This usually works well, as long as there is no Call Waiting on that line and people are not going to pick up the line while you are linked to the paging terminal.

### Local Connection

You might want to use Local Connect if the computer is located close to the terminal (within 50 feet or so). It provides a direct connection between a serial port in the paging terminal and a serial port on your computer. Its advantage is that it does not consume any telephone lines while linked up to the terminal, and the serial connection is usually faster. (Please note that a maintenance line for Zetron use is still required as discussed previously).

If you do use Local Connect, the computer will need to be reasonably close to the paging terminal. We can provide a 60-foot cable to connect between them. We do not recommend that you attempt a cable run much longer than this.

With Local Connect, the modem maintenance port on the terminal probably will not be used much. You might use it to call from a computer at home or a portable computer from somewhere else, for instance to watch paging traffic, but this is not very common. More likely, the maintenance port would only be used by Zetron Technical Support, when you wanted us to check on or change something.

**Note** Even if you use Local Connect, and thus have both Serial and Modem maintenance ports installed in the paging terminal, only one can be active at a time. In other words, the paging terminal will not allow more than one computer to access its database or do maintenance operations at the same time. This means that when you ask us to access your paging terminal to do something, you must be sure you are not watching traffic nor in ZlinkW, otherwise we will not be able to link up.

## Database Operations

This is how our system works: you make changes to your subscriber database on the office computer, using our ZbaseW software. Then you link up to the paging terminal and transfer the revised database to the paging terminal.

This means that the master database resides on your office computer, not on the paging terminal.

While there is a binary version of the paging system database residing on the paging terminal, the binary version is completely different from the subscriber data file on your office computer. Subscriber changes go only one way: from the office computer to the paging terminal. There is no direct way to use the binary version of the database from the paging terminal in your office computer.

Let us emphasize two main points here:

- Do frequent backups! The subscriber database on your PC must be backed up on a regular (and frequent) basis.
- Use only one computer!

The following sections cover these in more detail.

### Backups

Once you have spent much time entering your subscriber/pager info, you should back it up. This is easy using the handy Backup selection from the ZbaseW main menu. Alternatively, use your own favorite backup method. In any case, develop a proper multi-level backup system, and stick to it! This is discussed in more detail in the Operations manual that comes with the ZbaseW software.

### Only One Computer for Database

There should be one, and only one, office computer used for maintaining the paging system subscriber database file. If multiple computers are used, there is a high probability that changes will be made at one site and not the others. This soon results in both user complaints about system operation and general uncertainty about which version of the database found on the office computers is correct.

If you are in the position of needing to maintain the paging system subscriber database from several separate physical locations, it is recommended that you make use of an IP network to tie together all of the computers running ZbaseW with the single computer that is holding the database file and the paging terminal.

## Training and Classes

We offer a class once a month on the 2000 Series system. It is a general interest course, familiarizing you with the overall system and how to use it. It is suitable for owners/

operators, technicians, and ZbaseW operators. The classes are not a necessity - most customers simply use our manuals, easy-to-use ZbaseW software, and telephone support.

The classes are usually small, so if you want to concentrate on one aspect of the system, we can usually do so. The classes run three days. If interested, contact your salesperson.

# Trunk Cards and Connections

## Selecting a Phone Line

This section provides information that relates to the telco side of the paging terminal. It contains detailed connection listings for the RJ21 trunk connectors located on the backplane of the paging terminal that are used to make the connections to the telephone company lines. It also tells how the trunk cards operate and how to configure a trunk card for DID, E&M, or E-E operation. Adjustment procedures are given for the trunk cards as well as for the optional dial click cards.

This section should help you and your telephone expert provide an appropriate telephone connection. Support Engineers at Zetron are available to help you through the telephone service selection process. Different types of telephone lines can be connected to the Model 2100/2200, requiring specific interface card settings; End-to-End (loop start or ground start), selector level, E&M Tie-Trunk, or a local phone.

## Support for T1 Trunks

When the number of telephone lines being brought into a single location grows large enough, it becomes very attractive to switch to a more efficient method of supporting the call density. The Digital T1 Interface option for the 2000 Series paging terminals provides a way to do this. The initial and on-going costs for a T1 trunk are significantly lower than those for the equivalent number of conventional lines or trunk lines. The installation of the T1 interface is sufficiently different from the typical trunk cards that it is covered in its own documentation. For detailed information about installing this option, please see the 2000 Series T1 Interface Technical Manual, part number 025-9271.

## TELCO Connectors

A 66 type punch-down block (Zetron part number 802-0093 or equivalent) is recommended for connecting the backplane RJ21 50 pin connectors to telephone company supplied registered jacks.

For End-to-End loop start, End-to-End ground start, or DID trunks, cross connect only the RING/TIP pair from the Zetron terminal to the telephone company installed jacks. This is usually one or two RJ21 type jacks supplied by the telephone company.

For PABX E&M trunks, cross connect the RING/TIP and E/M pairs or directly terminate the RJ2EX jack of the Zetron terminal to the telephone company installed RJ21 registered jacks. This is usually three or four RJ21 type jacks supplied by the telephone company.

See Figure 9 on page 38. Primary and secondary protection is recommended using Zetron protection kit (Zetron part number 950-9040).

The following charts detail the pinout for the telephone RJ21 connectors. Wire colors are shown for standard 25-pair telephone cabling.

## Model 2100 Backplane TELCO Pinouts (702-9133 Rev C - J13)

| J13 Pin | Card Slot | Signal Name | Wire Color Main/Stripe | J13 Pin | Card Slot | Signal Name | Wire Color Main/Stripe |
|---|---|---|---|---|---|---|---|
| 1 | 6 | RING 6A | Blue/White | 26 | 6 | TIP 6A | White/Blue |
| 2 | 6 | M 6A | Orange/White | 27 | 6 | E 6A | White/Orange |
| 3 | 6 | RING 6B | Green/White | 28 | 6 | TIP 6B | White/Green |
| 4 | 6 | M 6B | Brown/White | 29 | 6 | E 6B | White/Brown |
| 5 | 7 | RING 7A | Slate/White | 30 | 7 | TIP 7A | White/Slate |
| 6 | 7 | M 7A | Blue/Red | 31 | 7 | E 7A | Red/Blue |
| 7 | 7 | RING 7B | Orange/Red | 32 | 7 | TIP 7B | Red/Orange |
| 8 | 7 | M 7B | Green/Red | 33 | 7 | E 7B | Red/Green |
| 9 | 8 | RING 8A | Brown/Red | 34 | 8 | TIP 8A | Red/Brown |
| 10 | 8 | M 8A | Slate/Red | 35 | 8 | E 8A | Red/Slate |
| 11 | 8 | RING 8B | Blue/Black | 36 | 8 | TIP 8B | Black/Blue |
| 12 | 8 | M 8B | Orange/Black | 37 | 8 | E 8B | Black/Orange |
| 13 | 9 | RING 9A | Green/Black | 38 | 9 | TIP 9A | Black/Green |
| 14 | 9 | M 9A | Brown/Black | 39 | 9 | E 9A | Black/Brown |
| 15 | 9 | RING 9B | Slate/Black | 40 | 9 | TIP 9B | Black/Slate |
| 16 | 9 | M 9B | Blue/Yellow | 41 | 9 | E 9B | Yellow/Blue |
| 17 | 10 | RING 10A | Orange/Yellow | 42 | 10 | TIP 10A | Yellow/Orange |
| 18 | 10 | M 10A | Green/Yellow | 43 | 10 | E 10A | Yellow/Green |
| 19 | 10 | RING 10B | Brown/Yellow | 44 | 10 | TIP 10B | Yellow/Brown |
| 20 | 10 | M 10B | Slate/Yellow | 45 | 10 | E 10B | Yellow/Slate |
| 21 | 9 | Radio | Blue/Violet | 46 | 9 | Radio | Violet/Blue |
| 22 | 9 | Radio | Orange/Violet | 47 | 9 | Radio | Violet/Orange |
| 23 | 10 | Radio | Green/Violet | 48 | 10 | Radio | Violet/Green |
| 24 | 10 | Radio | Brown/Violet | 49 | 10 | Radio | Violet/Brown |
| 25 | | Chassis GND | Slate/Violet | 50 | | Chassis GND | Violet/Slate |

[1] "-" means no connection.
[2] "Radio" means that the signal is used by radio cards in slots 9 & 10.
[3] The signal names ending in "A" are used by the single trunk card 702-9037. The dual trunk card 702-9117 uses signals ending in "A" for trunk A and signals ending in "B" for trunk B. The single trunk card 702-9037 has no connections to any signals ending in "B". For example, Signal "RING 10A" is a telco Ring signal from a trunk card plugged into slot number 10. If that card is a dual trunk, the Ring signal is for trunk A on the dual trunk.
[4] Connector J13 can serve trunk cards plugged into slots 6 through 10. With one radio card in slot #10, this means four telco lines in slots 6 through 9 with single trunk 702-9037s or eight telco lines if with dual trunk 702-9117s.
[5] The table shows the pins in numeric order, as they appear when looking directly at the connector. When looking at them on a punch-down block, you need to flip the left and right halves of the table, as the first pin on a punch-down block is pin 26, the second pin is 1, etc. Refer to the punch-down block diagram on page 129.

## Model 2200 Backplane TELCO Pinouts (702-9071 Rev C - J19)

| J19 Pin | Card Slot | Signal Name | Wire Color Main/Stripe | J19 Pin | Card Slot | Signal Name | Wire Color Main/Stripe |
|---|---|---|---|---|---|---|---|
| 1 | 7 | RING 7A | Blue/White | 26 | 7 | TIP 7A | White/Blue |
| 2 | 7 | M 7A | Orange/White | 27 | 7 | E 7A | White/Orange |
| 3 | 7 | RING 7B | Green/White | 28 | 7 | TIP 7B | White/Green |
| 4 | 7 | M 7B | Brown/White | 29 | 7 | E 7B | White/Brown |
| 5 | 8 | RING 8A | Slate/White | 30 | 8 | TIP 8A | White/Slate |
| 6 | 8 | M 8A | Blue/Red | 31 | 8 | E 8A | Red/Blue |
| 7 | 8 | RING 8B | Orange/Red | 32 | 8 | TIP 8B | Red/Orange |
| 8 | 8 | M 8B | Green/Red | 33 | 8 | E 8B | Red/Green |
| 9 | 9 | RING 9A | Brown/Red | 34 | 9 | TIP 9A | Red/Brown |
| 10 | 9 | M 9A | Slate/Red | 35 | 9 | E 9A | Red/Slate |
| 11 | 9 | RING 9B | Blue/Black | 36 | 9 | TIP 9B | Black/Blue |
| 12 | 9 | M 9B | Orange/Black | 37 | 9 | E 9B | Black/Orange |
| 13 | 10 | RING 10A | Green/Black | 38 | 10 | TIP 10A | Black/Green |
| 14 | 10 | M 10A | Brown/Black | 39 | 10 | E 10A | Black/Brown |
| 15 | 10 | RING 10B | Slate/Black | 40 | 10 | TIP 10B | Black/Slate |
| 16 | 10 | M 10B | Blue/Yellow | 41 | 10 | E 10B | Yellow/Blue |
| 17 | 11 | RING 11A | Orange/Yellow | 42 | 11 | TIP 11A | Yellow/Orange |
| 18 | 11 | M 11A | Green/Yellow | 43 | 11 | E 11A | Yellow/Green |
| 19 | 11 | RING 11B | Brown/Yellow | 44 | 11 | TIP 11B | Yellow/Brown |
| 20 | 11 | M 11B | Slate/Yellow | 45 | 11 | E 11B | Yellow/Slate |
| 21 | 15 | Radio | Blue/Violet | 46 | 15 | Radio | Violet/Blue |
| 22 | 15 | Radio | Orange/Violet | 47 | 15 | Radio | Violet/Orange |
| 23 | 16 | Radio | Green/Violet | 48 | 16 | Radio | Violet/Green |
| 24 | 16 | Radio | Brown/Violet | 49 | 16 | Radio | Violet/Brown |
| 25 | | Chassis GND | Slate/Violet | 50 | | Chassis GND | Violet/Slate |

[1] "-" means no connection.
[2] "Radio" means that the signal is used by radio card slots.
[3] The signal names ending in "A" are used by the single trunk card 702-9037. The dual trunk card 702-9117 uses signals ending in "A" for trunk A and signals ending in "B" for trunk B. The single trunk card 702-9037 has no connections to any signals ending in "B". For example, Signal "RING 10A" is a telco Ring signal from a trunk card plugged into slot number 10. If that card is a dual trunk, the Ring signal is for trunk A on the dual trunk.
[4] Connector J19 serves trunk cards plugged into card slots 7 through 11. This means five telco lines if the cards are single 702-9037s, ten telco lines if the cards are dual 702-9117s or six to nine if using a mixture of single and dual trunk cards.
[5] The table shows the pins in numeric order, as they appear when looking directly at the connector. When looking at them on a punch-down block, you need to flip the left and right halves of the table, as the first pin on a punch-down block is pin 26, the second pin is 1, etc. Refer to the punch-down block diagram on page 129.

## Model 2200 Backplane TELCO Pinouts (702-9071 Rev C - J20)

| J13 Pin | Card Slot | Signal Name | Wire Color Main/Stripe | J13 Pin | Card Slot | Signal Name | Wire Color Main/Stripe |
|---|---|---|---|---|---|---|---|
| 1 | 12 | RING 12A | Blue/White | 26 | 12 | TIP 12A | White/Blue |
| 2 | 12 | M 12A | Orange/White | 27 | 12 | E 12A | White/Orange |
| 3 | 12 | RING 12B | Green/White | 28 | 12 | TIP 12B | White/Green |
| 4 | 12 | M 12B | Brown/White | 29 | 12 | E 12B | White/Brown |
| 5 | 13 | RING 13A | Slate/White | 30 | 13 | TIP 13A | White/Slate |
| 6 | 13 | M 13A | Blue/Red | 31 | 13 | E 13A | Red/Blue |
| 7 | 13 | RING 13B | Orange/Red | 32 | 13 | TIP 13B | Red/Orange |
| 8 | 13 | M 13B | Green/Red | 33 | 13 | E 13B | Red/Green |
| 9 | 14 | RING 14A | Brown/Red | 34 | 14 | TIP 14A | Red/Brown |
| 10 | 14 | M 14A | Slate/Red | 35 | 14 | E 14A | Red/Slate |
| 11 | 14 | RING 14B | Blue/Black | 36 | 14 | TIP 14B | Black/Blue |
| 12 | 14 | M 14B | Orange/Black | 37 | 14 | E 14B | Black/Orange |
| 13 | 15 | RING 15A | Green/Black | 38 | 15 | TIP 15A | Black/Green |
| 14 | 15 | M 15A | Brown/Black | 39 | 15 | E 15A | Black/Brown |
| 15 | 15 | RING 15B | Slate/Black | 40 | 15 | TIP 15B | Black/Slate |
| 16 | 15 | M 15B | Blue/Yellow | 41 | 15 | E 15B | Yellow/Blue |
| 17 | 16 | RING 16A | Orange/Yellow | 42 | 16 | TIP 16A | Yellow/Orange |
| 18 | 16 | M 16A | Green/Yellow | 43 | 16 | E 16A | Yellow/Green |
| 19 | 16 | RING 16B | Brown/Yellow | 44 | 16 | TIP 16B | Yellow/Brown |
| 20 | 16 | M 16B | Slate/Yellow | 45 | 16 | E 16B | Yellow/Slate |
| 21 | 13 | Radio | Blue/Violet | 46 | 13 | Radio | Violet/Blue |
| 22 | 13 | Radio | Orange/Violet | 47 | 13 | Radio | Violet/Orange |
| 23 | 14 | Radio | Green/Violet | 48 | 14 | Radio | Violet/Green |
| 24 | 14 | Radio | Brown/Violet | 49 | 14 | Radio | Violet/Brown |
| 25 | | Chassis GND | Slate/Violet | 50 | | Chassis GND | Violet/Slate |

[1] "-" means no connection.
[2] "Radio" means that the signal is used by radio card slots.
[3] The signal names ending in "A" are used by the single trunk card 702-9037. The dual trunk card 702-9117 uses signals ending in "A" for trunk A and signals ending in "B" for trunk B. The single trunk card 702-9037 has no connections to any signals ending in "B". For example, Signal "RING 10A" is a telco Ring signal from a trunk card plugged into slot number 10. If that card is a dual trunk, the Ring signal is for trunk A on the dual trunk.
[4] Connector J20 serves trunk cards plugged into card slots 12 to 16. This means five telco lines if the cards are single 702- 9037s, ten telco lines if the cards are dual 702-9117s or six to nine if using a mixture of single and dual trunk cards.
[5] The table shows the pins in numeric order, as they appear when looking directly at the connector. When looking at them on a punch-down block, you need to flip the left and right halves of the table, as the first pin on a punch-down block is pin 26, the second pin is 1, etc. Refer to the punch-down block diagram on page 129.

## Model 2200 Main and Expansion Chassis Backplane Pinouts (702-9071 Rev E - J23)

| J23 Pin | Card Slot | Signal Name | Wire Color Main/Stripe | J23 Pin | Card Slot | Signal Name | Wire Color Main/Stripe |
|---|---|---|---|---|---|---|---|
| 1 | 7 | RING 7A | Blue/White | 26 | 7 | TIP 7A | White/Blue |
| 2 | 7 | RING 7B | Orange/White | 27 | 7 | TIP 7B | White/Orange |
| 3 | 8 | RING 8A | Green/White | 28 | 8 | TIP 8A | White/Green |
| 4 | 8 | RING 8B | Brown/White | 29 | 8 | TIP 8B | White/Brown |
| 5 | 9 | RING 9A | Slate/White | 30 | 9 | TIP 9A | White/Slate |
| 6 | 9 | RING 9B | Blue/Red | 31 | 9 | TIP 9B | Red/Blue |
| 7 | 10 | RING 10A | Orange/Red | 32 | 10 | TIP 10A | Red/Orange |
| 8 | 10 | RING 10B | Green/Red | 33 | 10 | TIP 10B | Red/Green |
| 9 | 11 | RING 11A | Brown/Red | 34 | 11 | TIP 11A | Red/Brown |
| 10 | 11 | RING 11B | Slate/Red | 35 | 11 | TIP 11B | Red/Slate |
| 11 | 12 | RING 12A | Blue/Black | 36 | 12 | TIP 12A | Black/Blue |
| 12 | 12 | RING 12B | Orange/Black | 37 | 12 | TIP 12B | Black/Orange |
| 13 | 13 | RING 13A | Green/Black | 38 | 13 | TIP 13A | Black/Green |
| 14 | 13 | RING 13B | Brown/Black | 39 | 13 | TIP 13B | Black/Brown |
| 15 | 14 | RING 14A | Slate/Black | 40 | 14 | TIP 14A | Black/Slate |
| 16 | 14 | RING 14B | Blue/Yellow | 41 | 14 | TIP 14B | Yellow/Blue |
| 17 | 15 | RING 15A | Orange/Yellow | 42 | 15 | TIP 15A | Yellow/Orange |
| 18 | 15 | RING 15B | Green/Yellow | 43 | 15 | TIP 15B | Yellow/Green |
| 19 | 16 | RING 16A | Brown/Yellow | 44 | 16 | TIP 16A | Yellow/Brown |
| 20 | 16 | RING 16B | Slate/Yellow | 45 | 16 | TIP 16B | Yellow/Slate |
| 21 | — | — | Blue/Violet | 46 | — | — | Violet/Blue |
| 22 | — | — | Orange/Violet | 47 | — | — | Violet/Orange |
| 23 | — | — | Green/Violet | 48 | — | — | Violet/Green |
| 24 | — | — | Brown/Violet | 49 | — | — | Violet/Brown |
| 25 | | Chassis GND | Slate /Violet | 50 | | Chassis GND | Violet/Slate |

[1] "-" means no connection.
[2] This connector is used only for 4-wire audio E&M configurations, and requires corresponding options on trunk cards.
[3] These are the transmit (outgoing) audio pairs.
[4] The table shows the pins in numeric order, as they appear when looking directly at the connector. When looking at them on a punch-down block, you need to flip the left and right halves of the table, as the first pin on a punch-down block is pin 26, the second pin is 1, etc. Refer to the punch-down block diagram on page 129.

# Adjustment Procedures

## Trunk Cards (702-9037 and 702-9117)

Each telephone interface line has four adjustments: audio level from the telco, audio level to the telco, and telco line balance R & C. These adjustments have been set at the factory, but usually need to be field- adjusted to match your actual phone lines.

The voice audio on each telephone interface line has an automatic gain control, which automatically compensates for differences in caller loudness and call-to-call gain changes.

The adjustments outlined below are important. They affect the recording of background noise, the compressing of speech silence, the decoding of DTMF keys, VOX disconnect features (if used), and modem communications.

There are different revisions of the Dual Trunk, which have different adjustment methods due to differences in the AGC circuit.

### How to Identify Dual Trunk Revisions

| Revision | Description |
|---|---|
| A - C | These boards have a single row of TEST points on the front panel. The ballast lamps are on the rear part of the board behind the matrix plugs, and thus can barely be seen when on (when the trunk is off-hook[1]). The revision letter is written near the white nylon connector near the middle of the board. |
| D & E | These boards have a single row of TEST points on the front panel. The ballast lamps are directly behind the TEST points so can easily be seen when on (when the trunk is off-hook[1]). The revision letter is written along the top edge of the board. |
| F & later | These boards have a double row of TEST points on the front panel. The revision letter is written along the top edge of the board. |

[1] The ballast lamps light when off-hook on DID, Ground Start, and some E&M configurations. You will not see them on End-to-End Loop Start and in some E&M configurations.

## To Tel Adjustment

The TO TEL adjustment can usually be left at the factory setting. Its setting is up to you. If voice prompts or tones coming from the paging system sound too low, turn the pot clockwise. If too loud, turn counterclockwise.

## From Tel Adjustment

In general, leave FROM TEL in the factory adjusted position. If there is too much silence deletion (voice recordings are incomplete, missing syllables from quiet or long distance callers) then turn the pot clockwise. If there is no silence deletion (voice recordings have

noise/static between words and when talker obviously paused) then turn the pot counterclockwise.

### ♦ Factory adjustment for From Tel

1. Attach a voltmeter to the FROM TEL and GND test points on the front of the trunk card. For dual trunks, be sure to attach to the A or B test points for the correct side of the dual trunk. Set the meter to measure AC volts RMS.
2. Have an assistant call into the paging system using a touch tone telephone. Call any tone and voice pager programmed in the database. It should have a long voice time so you have time to make the adjustment. Make sure you have called into the line you are adjusting. Call in on the real telephone line - do not just stick a butt set across the line.
3. Hold down one of the touch tone keys on the telephone.
4. Set the level appropriate for your revision of card, as follows:

| Trunks Covered | Settings |
|---|---|
| Single Trunks & Dual Trunks revs. A-C | Set the meter range for 1 to 2 Vac<br>Adjust FROM TEL for 0.75 Vrms +/- 0.25 V (0dBm)<br>If you are using the trunk for alpha communications via a dialup modem, use a slightly higher level of 1.0 Vrms ±0.25 V for more reliable modem connections. |
| Dual Trunks revs. D & E | Do not adjust. Factory adjustment only.<br>If you change the level in error, put it back to the approximate factory setting by: turning it all the way counter-clockwise until it clicks, then turning it six full turns clockwise. |
| Dual Trunks revs. F & up | • Install the shunt jumper (see page 81) in the KILL A or KILL B position while adjusting. Do not install the KILL jumper until ready to adjust, as DTMF decoding will probably not work with the jumper in.<br>• Set the meter range for 3 to 5 Vac. Adjust FROM TEL for 2.5 Vrms ±0.25 V (12dBm).<br>• Remove KILL jumper. |

Please note that you are positioning the knee of the AGC circuit for optimum operation.

## Hybrid Adjustment

**BAL R** and **BAL C** adjust the full duplex hybrid balance for the particular telephone line. Some adjustment is often required to compensate for the particular telephone line and routing to the telco office.

If you swap telephone lines around, or the telco changes your lines, you should perform this adjustment again.

The hybrid isolates what the Zetron trunk card puts onto the telco line from what it receives from the telco line, separating the two paths: inward and outward.

Adjustment of the hybrid circuit is important if you are using Voice Prompts (DTMF decoding improved), Alphanumeric Modem (modem detection improved), or PageSaver (DTMF decoding improved).

## Call Setup for Inbound Phone Lines

Using a DTMF telephone, call into the line you want to adjust. (This is sometimes difficult if you have multiple telephone lines in a trunk group from the CO or PBX. In this case, you may have to take the first trunks in the group temporarily out of service, or have several telephones to generate calls on.)

### ♦ Call setup procedure

1. Call the Status "P" number in ZbaseW (the prompt setup number). Refer to the Operations manual, System Voice Prompts section, for details.
2. After the prompt, enter the security code.
3. After the next prompt, enter 999.
4. One of the following will happen.
   a. On version 300 software, you will hear a 1000 Hz tone immediately; it will stay on for 1 minute.
   b. On version 310 software, you will hear a beep. Wait 5 seconds, then you will hear the 1000 Hz tone; it will stay on up to 4 minutes.

## Call Setup for Outbound Phone Lines

### ♦ Call setup procedure

1. Using a DTMF telephone, call into any inbound telephone line.
2. Call the Status "P" number in ZbaseW (the prompt setup number). Refer to the Series 2000 Operations manual (025-9034), System Voice Prompts section, for details.
3. After the prompt, enter the security code.
4. After the next prompt, enter 999. You will hear a beep.
5. Enter #ttu, where tt is the trunk address (e.g. 07 or 12), and u is the unit on the trunk (0 for trunk A, 1 for trunk B). For example, to adjust the trunk at address 13, side B, enter the # key then 131.
6. You will hear dial tone. What you do at this point depends on how the outbound trunk is used.

   PULSE DIAL:
   If you need to pulse dial a number on the outbound trunk (e.g. going into a pulse dial DID line), enter the number while the dial tone is playing.

   Wait five seconds for the outbound trunk to be seized. If the trunk is unavailable a whooping tone will be played and you will hear the same beep that you heard after entering 999 initially; at this point you could try to get the outbound trunk again.

DTMF DIAL:
If DTMF dialing is needed on the trunk, wait about two seconds after the dial tone goes away (meaning the outbound trunk has been seized), then dial.

RING BOX:
If you are connecting into a Zetron Ring Box, wait for the called device to answer then DTMF dial as needed.

7. Your outbound call should complete. The called party must answer the telephone. You can talk to the called party and explain that you are going to play a 1000 Hz tone for trunk adjustment purposes. They must leave the telephone off-hook. Tell them to be quiet while you are doing the adjustments - a lot of background noise on the telephone will make it difficult to get a good adjustment.
8. Enter *. The 1000 Hz tone will play on the outbound trunk for up to 4 minutes.
9. When done adjusting the trunk you may hang up, or enter # to return to the same beep that you heard after entering the 999 initially - you may then proceed to adjust another outbound trunk.

## Hybrid Adjustment

Following the call setup done above, perform the following procedure.

### ♦ Hybrid adjustment procedure

1. Attach a voltmeter to the FROM TEL and GND test pins on the front of the trunk card. Set the meter to measure 2 VRMS or less. See Figure 13.
2. While the tone is playing (see Call Setup procedures on page 79):

   Single Trunks & Dual trunk revisions A-E:

   a. Adjust the “BAL C” for minimum reading on your meter.
   b. Adjust the “BAL R” for minimum reading on your meter.
   c. Repeat steps “a” and “b” until further adjustment makes little difference.

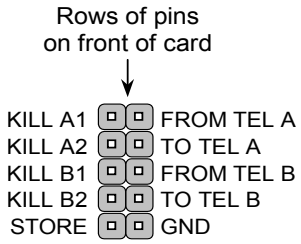
   Dual Trunks revision F & up:

   a. Install the shunt jumper in the KILL A1 to KILL A2 position for trunk A, or in the KILL B1 to KILL B2 position for trunk B. This will help you find your minimum reading. The KILL jumper must be removed after making the adjustment. Do not install the KILL jumper until ready to adjust, as DTMF decoding will probably not work with the jumper in.
   b. Adjust the “BAL C” for minimum reading on your meter.
   c. Adjust the “BAL R” for minimum reading on your meter.
   d. Repeat steps b and c until further adjustment makes little difference.
   e. Remove KILL jumper.

**Note** You are making the adjustment to get as little signal as possible bleeding from the “TO TEL” back into the “FROM TEL”.

## Dual Trunk Revision F (and later) Test Points and Kill Jumpers

*Figure 13: Dual Trunk Card Front Panel Test Points*




- To stop the AGC on trunk A from functioning, jumper from KILL A1 to KILL A2.
- To stop the AGC on trunk B from functioning, jumper from KILL B1 to KILL B2.
- To store the jumper, jumper from STORE to KILL B2, or from STORE to GND. Do not operate the trunk cards for normal traffic with the jumper in any but the storage position.

The right column of pins is the same as the single column of pins in pre-Rev. F trunks.

## Dual Trunk Monitor Card

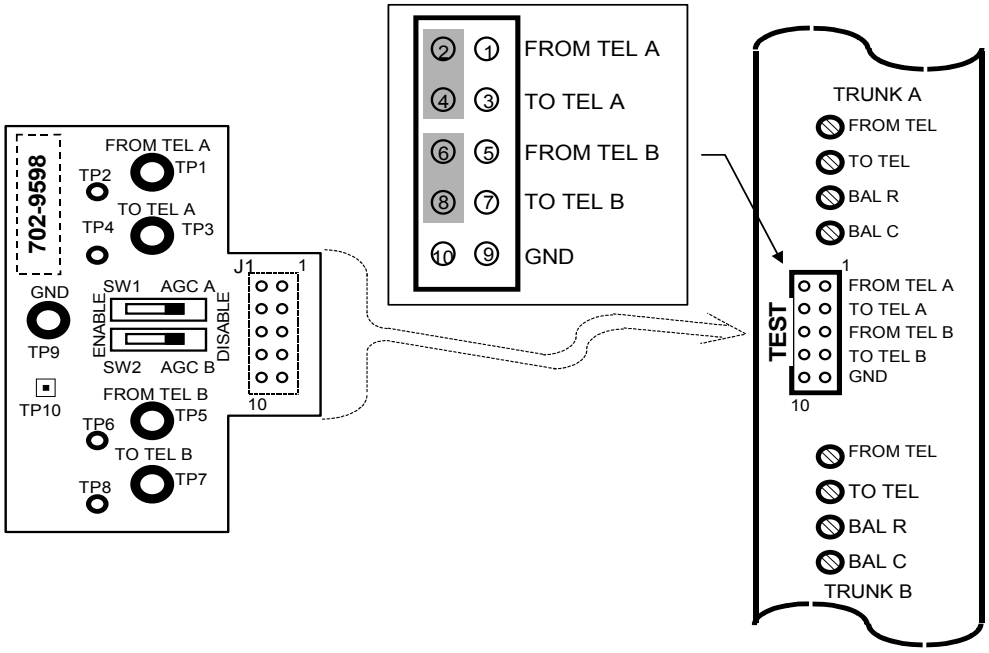
A convenient way to temporarily disable the AGC for the trunk being worked on is by installing the Model 2540 Trunk Card Monitoring Board (702-9598) and selecting "**DISABLE**" for **SW1** (Trunk A) or **SW2** (Trunk B) as appropriate.

Test probes must be carefully attached to the appropriate odd-numbered pins of the test port. The probes must not short to other pins of the TEST socket or to the chassis. This interface is most safely accomplished via the Trunk Card Monitoring Board, which acts as a "breakout" interface to the test points on the trunk card. Figure 14 illustrates the trunk card pinouts and their labels, as well as the layout of the monitoring board. On the monitoring board **TP1**, **TP3**, **TP5**, **TP7**, and **TP9** correspond numerically and functionally with Test Port pins 1, 3, 5, 7, and 9.

Additionally, Zetron has provided redundant test points **TP2** (**TP1**), **TP4** (**TP3**), **TP6** (**TP5**), **TP8** (**TP7**), and **TP10** (**TP9**). The odd-numbered test points best facilitate meter probe tips; whereas the even-numbered test points serve the oscilloscope probes best, or alternately facilitate direct solder connections to test equipment.

**Note** When using the Monitor Board, it is necessary to "strain relief" all test leads connected to the monitor board test points, in order to prevent the board from falling and disconnecting or possibly shorting TP7 to the faceplate of the trunk card. Strain relief for the test leads can be attained by looping the leads over the top of the lock buttons at the top of the trunk card(s).

*Figure 14: Dual Trunk Monitor Board (702-9598)*




## Dial Click Card

On newer Dual Dial Click cards (rev. C and later), you can usually avoid the following adjustment procedure. Instead, turn both pots up (clockwise) to maximum. This usually gives good results. If not, back down until you attain reliable operation.

This procedure applies only if the Dial Click Option for the 702-9037 card or the Dual Dial Click Option for 702-9117 card is installed. For this adjustment, you will need the following test equipment:

- Extender card (702-9087)
- Touch-tone telephone
- Rotary dial telephone
- Phone cord “Y” connector for your two telephones

This level adjustment is only affected by the adjustment pots on the dial click card. The “FROM TEL” pot on the telephone trunk card has no effect.

To make your adjustments, you will need access to the pots on the dial click card. So, power-down the Model 2100/2200 and place the trunk card you wish to adjust on the Extender Card and re-power the unit. Connect your two telephones together with the “Y” connector into the same telephone wall jack.

After the terminal completes booting up (about two minutes), call into the paging terminal and access a tone & voice pager that you have programmed with lots of voice time (e.g. 60 seconds). During the voice recording time, pickup the rotary telephone and hang up the

touch-tone telephone. Be sure to hang up, otherwise spurious noise and telephone line loading will change the sounds of the "clicks." Start dialing digits while adjusting the appropriate level pot on the dial click card (see chart below). Start at the fully counter-clockwise position and turn clockwise until the light on the dial click card blinks consistently with each dial click. (Actually, it blinks twice for each click).

Deviations from this point are sometime necessary. Experimenting helps to determine the optimum adjustment. Usually the level pot should be about midrange.

The adjustment points for the trunk cards and dial click cards are listed in Table 4.

*Table 4: Trunk Card and Dial Click Card Adjustment*

| Trunk Card | Dial Click Card | Adjustment Pot(s) |
|---|---|---|
| Single - 702-9037 | Single - 702-9010 | R20 (R18 is factory set) |
| Dual - 702-9117 | Dual - 702-9119 | R6 = trunk A, R28 = trunk B |

Contact the Zetron Technical Support at (425) 820-6363 if you are having trouble with unreliable dial click detection. We can offer additional tips and suggest various solutions. In extreme cases, we can use special software that requires users to "calibrate" each call by dialing 1-0 before the page so we can "know" the click pattern for that telephone and call.

**Note** There are also software adjustments for the Dual Dial Click card. Refer to the System Configuration Files section, or ask Zetron for assistance.

## MF Decoder Option

MF (Multi Frequency) is a dual-tone signaling method that is very similar to the common Touch-Tone DTMF (Dual Tone Multi Frequency) in that it uses two tones, but the tones are different frequencies (see Theory of Operation section for details).

The MF option board attaches to the dual trunk (rev. E or later) to decode these tones. Essentially, it provides a specialized tone decoder chip for each half of the Dual trunk.

The MF board is plugged into the existing connector J6 on the Dual Trunk card, and is secured and supported by a standoff.

There are no adjustments on the MF card. Jumper JP1 is used only for production testing of MF tone generation.

## Alarm Option

The Alarm Monitoring option requires that each Dual Trunk that might receive calls from alarm dialers be equipped with additional RAM and the Dual Alarm Receiver option board.

Software updates may be needed:

- the paging terminal software (ZPAGE) must be Version 310h0 or later;
- the ZbaseW application software must be Version 310J or later;
- and the Dual Trunk code must be Version 6F0 (2-way version) or later.

The oparam.cds file must be set up properly for Alarm Monitoring, especially parameter 1E with value 02 to dedicate End-to-End lines to this purpose; or parameter 18 (overdial) for using DID lines for both regular paging and alarm dialing. If there is a direct hookup between alarm dialer and trunk (hardwired), set up the line type as a Zetron Ring Box (so dialer units get dialtone).

Refer to the 2000 Series Paging Terminals Operating and Programming Manual (Part No. 025-9034-001), the Alarm Monitoring section for more information on this feature.

## Large RAM

Newer versions of the Dual Trunk have more RAM (Random Access Memory) than older versions. This additional RAM is required for support of certain features where trunks are used for both inbound and outbound calls, and for Alarm Monitoring.

If you have older dual trunks, contact Zetron regarding upgrading to obtain the larger RAM capability.

## 4-Wire Audio E&M

Four-wire audio E&M is supported as an option on the 2000 Series. Four-wire audio E&M is usually used to avoid audio problems (feedback, echo, loss, “ringing”, touchy hybrid balance) that occur when 2-wire audio lines (standard phone lines) are connected together. There are separate transmit and receive audio pairs to avoid these kinds of problems. Another reason to use this interface is that some telephone companies may require it to deliver DID service.

Each 702-9318 “Dual Trunk Interface, 4-wire audio E&M” option gives you two telephone lines. These are essentially modified Dual Trunks with an option board on them.

The six wires for each trunk are brought out in two ways. On the option board, there are two RJ-11 modular telephone jack connectors, one for each side of the Dual Trunk, which bring out all of the lines. These can be used instead of the regular 50-pin backplane connectors.

The “regular” telco connector, e.g., J19 for Slot 7 in a 2200, carries the two E&M signal lines and the two signal lines (Tip and Ring) for the receive audio. On Model 2200 systems with newer backplanes, the Tip and Ring lines for the transmit audio signals come out on connector J23. Model 2100s and older 2200s do not have this connector, so the RJ-11 jacks must be used.

When used for incoming DID calls, the 4-wire audio E&M option is usually combined with the MF option. This is commonly known as a “Type II interconnect”.

There is a jumper JP1 on the 4-wire option board. The jumper is in the “A” position when the paging terminal is acting as the facility side. This is usually used for incoming calls from a telco. The jumper is in the “B” position when the paging terminal is acting as the telco side.

There are no adjustments or additional jumpers on the board.

## Audio Daughter Board (4-wire audio E&M) Rev B

JP1, JP3, JP5 on the Audio Daughter Board must be set in order to provide proper supervision voltages to the “Trunk A” E&M pair.

JP2, JP4, JP6 on the Audio Daughter Board must be set in order to provide proper supervision voltages to the “Trunk B” E&M pair.

For this revision, E-Lead output is the dry contact of an N.O. or N.C. relay closure, as defined by jumpers JP5/JP6:

N.O.
Supervision voltage is only applied during the Off-Hook state, requiring IDLE (On-Hook) bias to be applied at the telephone company's CO Interface.

N.C.
Supervision is dropped during the Off-Hook state.

The E-lead supervision voltage is selected via JP3 / JP4. These jumpers select either (current-limited) -48 VDC, or 0 VDC to be applied to the E-lead drive relay “common” terminal, and then to the E-lead output (through JP5 / JP6).

The M-lead must be electrically forced to the Off-Hook state at the telco CO Interface, causing current flow through the optoisolator sensor, in order to cause an Off-Hook status detection. During the IDLE or On-Hook state, the telco CO Interface must become “N.O.” or biased to MATCH the JP1 / JP2 voltage selected.

Refer to Table 5 for information on jumper positions and signals for the Audio Daughter Board (Rev B).

*Table 5: Nominal Voltages for Audio Daughter Board*

| Trunk A/B | JPn Position (Aud.Daughter) | On-Hook Voltages (Idle Line State) | Off-Hook Voltages (Active Line) |
|---|---|---|---|
| A | JP1 A | M = -48 Vdc or N.O. | M = 0 Vdc Input |
| | B | M = 0 Vdc or N.O. | M = -48 Vdc Input |
| | JP3 A | E polarity = -48Vdc | E polarity = -48Vdc Out |
| | B | E polarity = GND | E polarity = GND Out |
| | JP5 A | E = N.O. | E = CLOSED Output |
| | B | E = N.C. | E = OPEN Output |
| B | JP2 A | M = -48 Vdc or N.O. | M = 0 Vdc Input |
| | B | M = 0 Vdc or N.O. | M = -48 Vdc Input |
| | JP4 A | E polarity = -48Vdc | E polarity = -48Vdc Out |
| | B | E polarity = GND | E polarity = GND Out |
| | JP6 A | E = N.O. | E = CLOSED Output |
| | B | E = N.C. | E = OPEN Output |

# Configuring Trunk Cards (702-9037 and 702-9117)

## Trunk Card Removal/Installation

Should it be necessary to remove/install a trunk card in the paging terminal, use the following procedure.

**♦ Trunk card removal/installation**

1. Remove the front cover.
2. Turn off the AC power.
3. Pull on the two black, nylon, retainer latches and gently wiggle the card out of its sockets. Slide the card out of the card cage and place it on anti-static foam.

**Note** Be sure to set the Address Switches on the replacement card to the same as those on the card removed from the card cage. If slot was empty, see chart of switch settings below.

4. Slide the new card into the card cage. Make sure that the nylon latches are extended toward you. Otherwise, the card edge connectors will not plug in. Push on the card stiffener to fully seat the card into the card cage.
5. Push on the nylon latches to lock the card into place.
6. Turn on the AC power. After about 30 seconds, you should see the SELECT lights on each card begin to blink in sequence as the CPU loads software into each card.

(If a new card was added, Zetron will need to change terminal configuration files for the card to work.)

## Switch Settings

The switches on the single or dual trunk card should be set to match the card cage slot number that the card is installed in. Revision D and later dual trunks may be addressed above 15 by removing JP5. This adds 16 to the switch address. Telephone trunk cards may be installed into slots 7 through 16 (on Model 2200), slots 4 through 13 (on Model 2200EX), or slots 6 through 10 (on Model 2100). Please see Table 6 for the switch settings.

## Jumper Matrix Settings

On each telephone interface card (702-9037 Trunk or 702-9117 Dual Trunk), the configuration jumpers have been unified onto small daughter circuit cards named "MATRIX". To make the telephone interface operate properly, the matrix plug for every telephone line must be in the correct position, and the software must be configured to operate the card properly. The matrix card completes the proper electrical paths for the different kinds of telephone interfaces (DID, End-to-End, and so forth). It also presents an identification that the Trunk software can read and compare to the programmed Line Type. A trunk card will refuse to operate if the hardware matrix plug and the software Line Type disagree. (See *System Configuration Files* on page 217 for information on how to set the Line Type).

*Table 6: Card Slot Switch Settings*

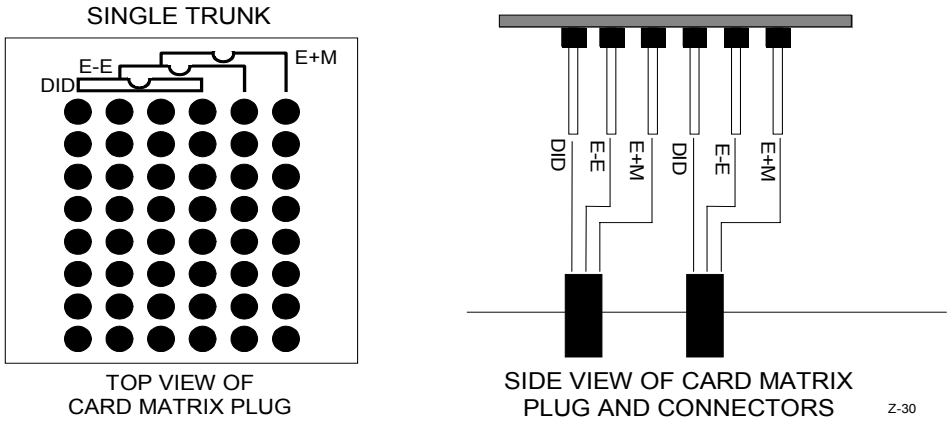
| Switches | Card Slot Numbers | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 4^ | 5^ | 6*^ | 7*^ | 8*^ | 9*^ | 10*^ | 11^ | 12^ | 13^ | 14 | 15♦ | 16♦ |
| 1 | A | B | A | B | A | B | A | B | A | B | A | B | A |
| 2 | A | A | B | B | A | A | B | B | A | A | B | B | A |
| 3 | B | B | B | B | A | A | A | A | B | B | B | B | A |
| 4 | A | A | A | A | B | B | B | B | B | B | B | B | A |
| 5 | A | A | A | A | A | A | A | A | A | A | A | A | A |
| 6 | A | A | A | A | A | A | A | A | A | A | A | A | A |
| 7 | A | A | A | A | A | A | A | A | A | A | A | A | A |
| CRT/8 | A | A | A | A | A | A | A | A | A | A | A | A | A |

* = Model 2100 slots
^ = Model 2200EX slots - JP5 is to be removed
♦ = Model 2200 available with rev B or later backplane

**Note** The Matrix cards and Line Types are factory set for your particular installation from information obtained from your technical staff. In general, you should not have to change these settings unless your telephone line configuration changes.

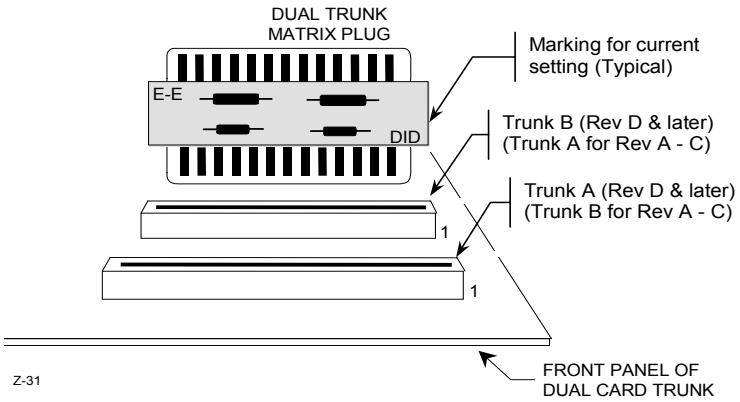
On the 702-9037 card, the matrix plug is a small board with six rows of connector pins. The matrix position is selected with the help of the silk-screened labels on the board and the illustration in Figure 15. Each label points to the two rows of pins to insert into the two SIP sockets on the trunk card. Orient the matrix so that the Line Type labels are closest to the front panel of the card.

*Figure 15: The Single Trunk Card Matrix Plug*




On the 702-9117 dual trunk card, there are two small 702-9122 circuit boards, as shown in Figure 16, which can be inserted into their circuit connectors four different ways. The matrix card plugged into socket J3 is for Trunk A, and the one in J4 is for Trunk B. The selected setting is the one plugged into the connector and facing the legend “1” on the 702-9117 board.

*Figure 16: The Dual Trunk Card Matrix Plug*



**Note** Rev D and later dual trunk must use Rev C and later matrix plugs. Do not install Rev C matrix plugs on Rev A - C dual trunks.

Table 7 summarizes the matrix settings. Please refer to *System Configuration Files* on page 217 for information on how to set the Line Type for the type of telephone line.

*Table 7: Trunk Card Matrix Settings Summary*

| Telco line type | 702-9037 Matrix | 702-9117 Matrix | Loop supervision |
|---|---|---|---|
| Central Office DID/Selct. Lvl. | DID | DID | immediate or wink start |
| Central Office End-to-End | E-E | E-E | loop start |
| PABX loop start tie-trunk | DID | DID | loop start |
| PABX extension (station) | E-E | E-E | loop start |
| PABX E&M trunk | E+M | E+M | type I 2-wire audio |
| PABX trunk ground start | special | GS | C.O. End-to-End GND Start |
| Operator phone hardwired | DID | DID | loop start |

The software settings that are available for field programming consist of the following:

- Telco Line Type
- Number of Rings before Answer
- Number of Feed Digits
- Line Permissions
- Block Definitions (each block is programmable for Service Code,
- Block #, Prefix/Adder, Low Bound, High Bound)

These specify how the Trunk card is to answer calls and what subscriber numbers it should service. These values reside in the file oparam.cds (described in detail under *OPARAM.CDS File* on page 218) which is stored on the hard disk of the paging terminal. This file is read only when the paging terminal is powered on or after a reboot operation. Therefore, once programming changes have been made they will not take effect until the paging terminal is rebooted (or powered up). The details for constructing the actual commands are given in *System Configuration Files* on page 217.

# Configuring for DID Operation

## Central Office (C.O.) DID Description

Phone company central offices provide a type of access called Selector Level DID (Direct Inward Dial). It is normally higher cost than end-to-end. In the case of a DID trunk, the telephone line represents a bank of sequential telephone numbers (for example 555-34XX covers the 100 numbers from 555-3400 through 555-3499). When a caller dials one of the numbers in a bank, the telephone switch serving the paging terminal sends, via pulses or Touch Tone, the last two (up to seven) digits of the telephone number dialed down the wire pair to the Model 2200 telephone trunk card. The terminal converts the digits into the pager number. No prompt or greeting is issued to the caller for the pager number since the pager digits are automatically sent by the telephone company. The result, paging access is quicker on selector-level trunks than on plain end-to-end lines, since the customer does not need to overdial.

When ordering your selector level service from the telephone company, contact the Centralized Operations Group rather than the local area business office. The COG is better equipped to handle complex signaling requirements. Be sure to request either “immediate dial” or “wink start” service. “Delay dial” is not supported by the interface card.

## DID Installation

### ♦ Installing a DID line

1. Confirm that the DID line has been ordered to out-pulse or DTMF the same number of digits that the Terminal expects. The DID line must be Immediate Dial Start or Wink Start. Delay Dial will not work.
2. Remove each trunk card from the Terminal and check that the matrix plug is in the DID position for those trunks that should be set for DID (selector level). Refer to *Jumper Matrix Settings* on page 87 for more details on the matrix plug.
3. You can test each DID line with a plain dial or DTMF telephone. Connect the telephone right to the Tip-Ring pair. Lift the telephone handset and dial the last digits of a pager number. Confirm that the front panel LOOP indicator lights when you lift the handset (and pulses as the dial turns). Also, note that the incandescent lamps on the trunk card glow steadily when the telephone is off hook (and blink with the loop light).
4. Unplug the telephone set, and plug in the DID line. On a telephone connected to an outside line, dial one of the seven-digit DID numbers. The Terminal should go through the same sequence as in step 3.
5. If you hear a fast busy after dialing, or the call does not go through, the tip and ring leads may be installed backwards. Reverse them and try step 4 again.
6. If incoming DID numbers do not match any pager numbers, the Terminal will answer the call, generate busy tones or a whoop for a few seconds, and hang up. Make sure that you are dialing a real pager number that you have set up. See the

2000 Series Paging Terminal Operating and Programming manual (025-9034-001) for more information on database operations. If the database is okay, the Terminal may be incorrectly configured for the feed digit range provided by your Telco. Contact Zetron Technical Support for assistance.

# Operator Local Station

The local telephone may be used to perform priority paging in local and emergency situations from touch-tone telephones. The Terminal provides 48 Vdc to power the telephone set to operate its audio and touch tone circuitry. The caller places a page by lifting the handset of the local telephone, waiting for the prompt and overdialing the pager number and entering the message.

This page is then assigned priority 3, no matter what priority the pager is normally set to via the database. You can set a higher priority in the `trunks.cus` files (see *System Configuration Files* on page 217).

Hardware settings are the same as for DID selector level (see previous paragraphs). Software settings specify local operator telephone priority input.

# Configuring for End-to-End Loop Start Operation

## End-to-End Loop Start/PABX Station Description

End-to-end loop start (pots) telephone lines are the same as those for private residences. A single telephone number, when dialed by any paging customer, causes a ringing signal to be sent down the telephone wire pair to the Terminal. When the Terminal answers the line by drawing loop current across the tip-ring wire pair (off-hook), the telephone company connects audio between the caller and the Terminal and reverses the battery voltage to the telephone. The Terminal then sends a single beep or a voice message to the caller to have the caller key a pager number on his/her telephone keypad. This so-called “overdialing” after the call is connected must be performed with touch-tone telephones equipped with polarity guard. Rotary telephone dial click decode is available as an option.

## End-to-End Installation

### ♦ Installing an End-to-End line

1. Confirm that the end-to-end line has been ordered as expected. The end-to-end line must be Loop Start.

2. Remove each trunk card from the Terminal and check that the Matrix plug is in the E&E position for those trunks that should be set for end-to-end. Refer to *Jumper Matrix Settings* on page 87 for more details on the matrix plug.
3. You can test each line by calling into the terminal on each end-to-end telephone number. The RING light on the trunk will light when the Telco is providing AC ringing voltage to the line. The ANSWER light will come on (and the RING light goes out) when the trunk card answers the incoming call. Note that the LOOP LED and the incandescent lamps on the trunk card are not used in the end-end configuration and will not light.

# Configuring for PABX Operation

## Private Branch Exchange (PABX) Tie-Trunk Description (E&M)

A different type of telephone line, similar to a selector-level trunk, is commonly found on in-plant private branch exchanges (PABX); this trunk is sometimes called an E&M Tie-Trunk. This type of trunk normally allows the caller to use either Rotary Dial or Touch-Tone telephones. The caller accesses the Terminal by dialing a short one or two-digit access code (similar to getting an outside line by dialing “9”), which causes the PABX controller to draw current through a separate M-lead. The Terminal detects this current and sends a beep to the caller for the pager access code. As the caller keys or dials the pager access code, the PABX converts the digits into current pulses on the M-lead (in some cases, conversion to pulses is not performed and DTMF is sent to the Terminal). Unlike a normal selector-level trunk, the telephone digits are not a bank of numbers and pulsing occurs as the PABX forwards the caller’s dialed digits.

Connection to a PABX may be made to the Terminal through either an End-to-End station extension or a tie-trunk. End-to-End installation is described on page 91, tie-trunk is described here. Tie-trunk connection is the preferred method of interfacing a paging Terminal to the telephone system. By dialing a short access code, the caller obtains the paging function, rather than dialing a full extension number. PABX trunk service generally provides access from any type of on-premise telephone, rotary, DTMF, or electronic. The caller does not need a DTMF telephone as in End-to-End overdialing. In addition, the Terminal is able to detect when the caller disconnects, which speeds through the call processing to make paging available sooner than on an End-to-End installation.

A brief description of trunk-accessible paging on a PABX is appropriate at this point. A caller dials a short access code (similar to accessing an outside line) to obtain radio paging. If the PABX is senderized, the caller can then dial the pager code immediately following the access code. A senderized PABX can store the caller’s dialed digits and independently place the telephone call to a calling party. This store-and-forward of the digits makes easy work for the caller. If the PABX is not senderized, then it repeats the dialed digits to the Terminal as the caller enters them. On a non-senderized PABX, the caller must dial the paging access code and wait for the PABX to cut through to the Terminal, the Terminal to answer, and the Terminal to send a Single Beep to the caller.

Then the caller may enter the pager code. Ask your telephone expert which type of trunk you are using (describe the sequence of events above if they do not recognize the terms “senderized” or “store-and-forward”), then instruct your callers as to how to use the system.

The Table 6 may assist you in interfacing the Model 2200 to the PABX for trunk access. A PABX can normally provide a loop start trunk or End-to-End overdial station line. The best connection is normally loop start trunk since the paging terminal can tell the PABX when the call is finished (in end-to-end this is done by timeout which wastes trunk handling time). Some PABXs have electronic telephones that do not provide DTMF tones for overdialing, so End-to-End does not work there either. Some PABX operator consoles are electronic and do not provide DTMF tones for overdialing; again End-to-End does not work there.

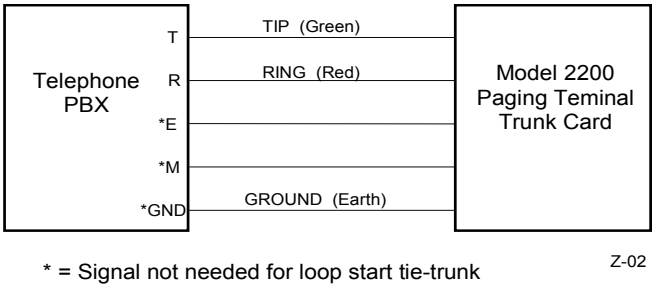
Most of the time, a loop start trunk connection from the PABX will provide DTMF tones since this type of trunk is often used for “outside line” access to a Telco central office which requires Touch-Tone. Some PABXs can use E&M signaling for these trunks. As Table 6 shows, Zetron supports E&M Type I with 2-wire audio. Call Zetron Technical Support for assistance with your telephone PABX installation.

*Table 8: PABX in relation to E&M support*

| PABX Brand and Type | PABX Card and Straps | Zetron Card and Straps | Supported Features |
|---|---|---|---|
| Northern Telecom<br>SL-1<br>SL-1XN | QPC-219<br><br>QPC-450 | 702-9037, -9117<br>E-E GND Start<br>Same as QPC-219 | Calling Party Disconnect |
| Rolm CBX | M/N-8557 | 702-9037, -9117<br>DID | Calling Party Disconnect |
| AT&T Dimension | LC08 | 702-9037, -9117<br>E-E GND Start | Calling Party Disconnect |

**Note** For E&M Tie-Trunk applications, the Facility Interface Code (FIC) is a TL-11E for the Zetron end, and a TL-11M for the telco end. Zetron requires 2-wire audio with a cable size of five wires. Refer to *Trunk Card Specifications (702-9037 and 702-9117)* on page 18 for the FCC registration numbers.

*Figure 17: PBX Tie-trunk connection diagram*




**Note** Set JP-1 on Z-bus backplane (702-9071) rev B or later to position "A" to set telco GND to system chassis.

### Private Branch Exchange (PABX) Ground Start Description (GS)

(also known as *End-to-End Ground Start*)

Some PABX systems are best interfaced to the 2000 Series Paging Terminal with a Ground Start interface. This is a Trunk-level interface to the PABX, having the same advantages as the PABX E&M interface described above (short access code, senderized, etc.); it differs in the electrical interface. It uses a 2-wire connection (as opposed to the E&M 4-wire connection) to the PABX.

Refer to *Theory of Operation* on page 149 for call processing flowcharts and signal descriptions.

## Dual Trunk Card Memory Upgrade

In order to run firmware version 6F7 of later in the dual trunk cards (702-9117) it may be necessary to perform an upgrade to the trunk card in order to increase the available RAM from 256K to 1M. This would only apply to systems already in service since new systems would be equipped with the current version of dual trunk card at the factory.

The first indicator of whether or not the card can be upgraded at all is given by looking at the TEST pins on the front edge of the socket (see Figure 14 on page 82). If there is only a single row of test point pins instead of a double row, then the board is too old to upgrade and must be replaced with a new board.

Assuming that the board passes the first test and has two rows of test points, the next thing to check is the size of socket in U17 and the size of the IC in the socket.

- If U17 is a 28-pin socket with a 28-pin RAM chip in it, then they must both be replaced. While you might be able to do this in the field, Zetron recommend that you contact the factory and arrange to return the card so that our technicians can do the work here.
- If the socket in U17 is a 32-pin socket with only a 28-pin RAM chip installed, then only the RAM needs to be replaced with a larger unit. This upgrade can reasonably be accomplished in the field. Contact Zetron and inquire about dual trunk card upgrade option, part number 950-0222.
- If U17 is a 32-pin socket and there is a 32-pin RAM installed, then no upgrade is needed. The dual trunk card already has the larger capacity RAM installed.

# Radio System

## Overview

This section provides information that relates to the radio side of the paging terminal. It contains detailed connection listings for the radio station connectors located on the backplane of the paging terminal that are used to make the connections to the radio transmitter equipment. It also tells how the station cards operate and how to configure the jumpers on a station card and make any necessary adjustments. This section also describes the different paging terminal/radio transmitter hook-up arrangements, including remote control operation. Illustrations are provided to support the hook-up descriptions.

This section should help you and your radio expert provide an appropriate radio connection. Engineers at Zetron are available to help you through the installation process. Different types of radio systems can be connected to the Model 2100/2200, requiring specific interface card settings; analog, analog + digital, multi-site zone control, and simulcast.

## General System Design

As listed in the Operating and Programming manual (025-9034-001), the tone range for the various analog paging formats covers a wide range of frequencies, often with tones of very short duration. This places a good deal of importance on audio pre-emphasis/de-emphasis in a radio to guarantee flat tone transmission. A single pole filter present in many microphone circuits pre-emphasizes the tones generated by the terminal to a point where decoding by a pager is not possible. For more information on tone de-emphasis, refer to *Station Card Removal/Installation* on page 105, specifically the subtopic *Jumper Settings* on page 106.

FM Transmitter deviation for analog paging should be set for about 3.5KHz to maximize paging range, but not much more to avoid tone clipping distortion which can cause unreliable pager decoding. Also be careful that any link equipment between the Model

2100 or 2200 and the transmitter does not introduce tone distortion or produce too much audio level compression, which may fool analog tone decoders.

Also, note that some paging tones are very close to the 2175 Hz tone often used and removed by tone remote transmitter control equipment. Therefore, it is *not* recommended that tone remote control equipment be engineered into the paging system. Instead, co-locate the paging terminal and the transmitter. If this is not possible, then a D.C. remote could be used.

Call Zetron Technical Support for further information.

**Note** Except where noted, station card Part No. 702-9038 and station card Part No. 702-9441 are equivalent.

## Radio Connectors

Radio transmitter connections are brought into the Model 2100/2200 using a telco standard 25-pair cable. The 50-pin mating connector is mounted to the Model 2100/2200 lower backplane (Z-bus) board, visible below the circuit card cage after the unit's front door has been removed.

Ground the cabinet to a common earth connection using any of the screws holding the backplane to the rear panel, or any of the nuts holding the side panels to the power supply shelf.

There are no internal protection devices for lightning strikes, so external protection devices, such as are available from Zetron are highly recommended to protect your investment.

The charts on the following pages detail the pinout for the radio connectors.

## Model 2100 Backplane Radio Pinouts (702-9133 Rev C - J13)

| J13 Pin | Card Slot | Signal Name | Wire Color Main/Stripe | J13 Pin | Card Slot | Signal Name | Wire Color Main/Stripe |
|---|---|---|---|---|---|---|---|
| 1 | 6 | Telco | Blue/White | 26 | 6 | Telco | White/Blue |
| 2 | 6 | Telco | Orange/White | 27 | 6 | Telco | White/Orange |
| 3 | 6 | Telco | Green/White | 28 | 6 | Telco | White/Green |
| 4 | 6 | Telco | Brown/White | 29 | 6 | Telco | White/Brown |
| 5 | 7 | Telco | Slate/White | 30 | 7 | Telco | White/Slate |
| 6 | 7 | Telco | Blue/Red | 31 | 7 | Telco | Red/Blue |
| 7 | 7 | Telco | Orange/Red | 32 | 7 | Telco | Red/Orange |
| 8 | 7 | Telco | Green/Red | 33 | 7 | Telco | Red/Green |
| 9 | 8 | Telco | Brown/Red | 34 | 8 | Telco | Red/Brown |
| 10 | 8 | Telco | Slate/Red | 35 | 8 | Telco | Red/Slate |
| 11 | 8 | Telco | Blue/Black | 36 | 8 | Telco | Black/Blue |
| 12 | 8 | Telco | Orange/Black | 37 | 8 | Telco | Black/Orange |
| 13 | 9 | Telco | Green/Black | 38 | 9 | Telco | Black/Green |
| 14 | 9 | Telco | Brown/Black | 39 | 9 | Telco | Black/Brown |
| 15 | 9 | Telco | Slate/Black | 40 | 9 | Telco | Black/Slate |
| 16 | 9 | Telco | Blue/Yellow | 41 | 9 | Telco | Yellow/Blue |
| 17 | 10 | Telco | Orange/Yellow | 42 | 10 | Telco | Yellow/Orange |
| 18 | 10 | Telco | Green/Yellow | 43 | 10 | Telco | Yellow/Green |
| 19 | 10 | Telco | Brown/Yellow | 44 | 10 | Telco | Yellow/Brown |
| 20 | 10 | Telco | Slate/Yellow | 45 | 10 | Telco | Yellow/Slate |
| 21 | 9 | Recv Audio Hi | Blue/Violet | 46 | 9 | Recv Audio Lo | Violet/Blue |
| 22 | 9 | Xmit Audio Lo | Orange/Violet | 47 | 9 | Xmit Audio Hi | Violet/Orange |
| 23 | 10 | Recv Audio Hi | Green/Violet | 48 | 10 | Recv Audio Lo | Violet/Green |
| 24 | 10 | Xmit Audio Lo | Brown/Violet | 49 | 10 | Xmit Audio Hi | Violet/Brown |
| 25 | | Chassis GND | Slate/Violet | 50 | | Chassis GND | Violet/Slate |

[1] "Telco" means that the signal is used by telco card slots.
[2] The table shows the pins in numeric order, as they appear when looking directly at the connector. When looking at them on a punch-down block, you need to remember that the first pin on a punch-down block is pin 26, the second pin is 1, etc. Refer to the punch-down block diagram on page 129.

## Model 2100 Backplane Radio Pinouts (702-9133 Rev C - J14)

| J14 Pin | Card Slot | Signal Name | Wire Color Main/Stripe | J14 Pin | Card Slot | Signal Name | Wire Color Main/Stripe |
|---|---|---|---|---|---|---|---|
| 1 | 9 | Recv Audio Hi | Blue/White | 26 | 9 | Recv Audio Lo | White/Blue |
| 2 | 9 | DIG Mode | Orange/White | 27 | 9 | Xmit Request | White/Orange |
| 3 | 9 | Xmit Audio Hi | Green/White | 28 | 9 | Xmit Audio Lo | White/Green |
| 4 | 9 | COR/CAS | Brown/White | 29 | 9 | BUSY | White/Brown |
| 5 | 9 | Ground | Slate/White | 30 | 9 | DIG Data | White/Slate |
| 6 | 9 | ANA PTT COM | Blue/Red | 31 | 9 | ANA PTT NO | Red/Blue |
| 7 | 9 | ANA PTT NC | Orange/Red | 32 | 9 | DIG PTT NC | Red/Orange |
| 8 | 9 | DIG PTT COM | Green/Red | 33 | 9 | DIG PTT NO | Red/Green |
| 9 | 9 | Zone ADR 8 | Brown/Red | 34 | 9 | Zone ADR 4 | Red/Brown |
| 10 | 9 | Zone ADR 2 | Slate/Red | 35 | 9 | Zone ADR 1 | Red/Slate |
| 11 | 9 | AUX NO | Blue/Black | 36 | 9 | AUX NC | Black/Blue |
| 12 | 9 | AUX COM | Orange/Black | 37 | | Chassis GND | Black/Orange |
| 13 | 10 | Recv Audio Hi | Green/Black | 38 | 10 | Recv Audio Lo | Black/Green |
| 14 | 10 | DIG Mode | Brown/Black | 39 | 10 | Xmit Request | Black/Brown |
| 15 | 10 | Xmit Audio Hi | Slate/Black | 40 | 10 | Xmit Audio Lo | Black/Slate |
| 16 | 10 | COR/CAS | Blue/Yellow | 41 | 10 | BUSY | Yellow/Blue |
| 17 | 10 | Ground | Orange/Yellow | 42 | 10 | DIG Data | Yellow/Orange |
| 18 | 10 | ANA PTT COM | Green/Yellow | 43 | 10 | ANAPTT NO | Yellow/Green |
| 19 | 10 | ANA PTT NC | Brown/Yellow | 44 | 10 | DIG PTT NC | Yellow/Brown |
| 20 | 10 | DIG PTT COM | Slate/Yellow | 45 | 10 | DIG PTT NO | Yellow/Slate |
| 21 | 10 | Zone ADR 8 | Blue/Violet | 46 | 10 | Zone ADR 4 | Violet/Blue |
| 22 | 10 | Zone ADR 2 | Orange/Violet | 47 | 10 | Zone ADR 1 | Violet/Orange |
| 23 | 10 | AUX PTT NO | Green/Violet | 48 | 10 | AUX PTT NC | Violet/Green |
| 24 | 10 | AUX PTT COM | Brown/Violet | 49 | | Chassis GND | Violet/Brown |
| 25 | | Chassis GND | Slate/Violet | 50 | | Chassis GND | Violet/Slate |

[1] When the Model 2100 is equipped with remote control option (950-9074 or 950-9133), TX Audio and RX Audio signals may be obtained from backplane connector J13. In these cases, you do not need to use connector J14.

[2] The table shows the pins in numeric order, as they appear when looking directly at the connector. When looking at them on a punch-down block, you need to remember that the first pin on a punch-down block is pin 26, the second pin is 1, etc. Refer to the punch-down block diagram on page 129.

## Model 2200 Backplane Radio Pinouts (702-9071 Rev C - J19)

| J19 Pin | Card Slot | Signal Name | Wire Color Main/Stripe | J19 Pin | Card Slot | Signal Name | Wire Color Main/Stripe |
|---|---|---|---|---|---|---|---|
| 1 | 7 | Telco | Blue/White | 26 | 7 | Telco | White/Blue |
| 2 | 7 | Telco | Orange/White | 27 | 7 | Telco | White/Orange |
| 3 | 7 | Telco | Green/White | 28 | 7 | Telco | White/Green |
| 4 | 7 | Telco | Brown/White | 29 | 7 | Telco | White/Brown |
| 5 | 8 | Telco | Slate/White | 30 | 8 | Telco | White/Slate |
| 6 | 8 | Telco | Blue/Red | 31 | 8 | Telco | Red/Blue |
| 7 | 8 | Telco | Orange/Red | 32 | 8 | Telco | Red/Orange |
| 8 | 8 | Telco | Green/Red | 33 | 8 | Telco | Red/Green |
| 9 | 9 | Telco | Brown/Red | 34 | 9 | Telco | Red/Brown |
| 10 | 9 | Telco | Slate/Red | 35 | 9 | Telco | Red/Slate |
| 11 | 9 | Telco | Blue/Black | 36 | 9 | Telco | Black/Blue |
| 12 | 9 | Telco | Orange/Black | 37 | 9 | Telco | Black/Orange |
| 13 | 10 | Telco | Green/Black | 38 | 10 | Telco | Black/Green |
| 14 | 10 | Telco | Brown/Black | 39 | 10 | Telco | Black/Brown |
| 15 | 10 | Telco | Slate/Black | 40 | 10 | Telco | Black/Slate |
| 16 | 10 | Telco | Blue/Yellow | 41 | 10 | Telco | Yellow/Blue |
| 17 | 11 | Telco | Orange/Yellow | 42 | 11 | Telco | Yellow/Orange |
| 18 | 11 | Telco | Green/Yellow | 43 | 11 | Telco | Yellow/Green |
| 19 | 11 | Telco | Brown/Yellow | 44 | 11 | Telco | Yellow/Brown |
| 20 | 11 | Telco | Slate/Yellow | 45 | 11 | Telco | Yellow/Slate |
| 21 | 15 | Recv Audio Hi | Blue/Violet | 46 | 15 | Recv Audio Lo | Violet/Blue |
| 22 | 15 | Xmit Audio Lo | Orange/Violet | 47 | 15 | Xmit Audio Hi | Violet/Orange |
| 23 | 16 | Recv Audio Hi | Green/Violet | 48 | 16 | Recv Audio Lo | Violet/Green |
| 24 | 16 | Xmit Audio Lo | Brown/Violet | 49 | 16 | Xmit Audio Hi | Violet/Brown |
| 25 | | Chassis GND | Slate/Violet | 50 | | Chassis GND | Violet/Slate |

[1] "-" means no connection
[2] "Telco" means that the signal is used by telco card slots.
[3] If radio transmitters are remote tone-controlled, just audio signals TX AUDIO HI/LO are necessary. Therefore, connector J19 can handle five telco lines and two tone-controlled radios.
[4] The table shows the pins in numeric order, as they appear when looking directly at the connector. When looking at them on a punch-down block, you need to remember that the first pin on a punch-down block is pin 26, the second pin is 1, etc. Refer to the punch-down block diagram on page 129.

## Model 2200 Backplane Radio Pinouts (702-9071 Rev C - J20)

| J20 Pin | Card Slot | Signal Name | Wire Color Main/Stripe | J20 Pin | Card Slot | Signal Name | Wire Color Main/Stripe |
|---|---|---|---|---|---|---|---|
| 1 | 12 | Telco | Blue/White | 26 | 12 | Telco | White/Blue |
| 2 | 12 | Telco | Orange/White | 27 | 12 | Telco | White/Orange |
| 3 | 12 | Telco | Green/White | 28 | 12 | Telco | White/Green |
| 4 | 12 | Telco | Brown/White | 29 | 12 | Telco | White/Brown |
| 5 | 13 | Telco | Slate/White | 30 | 13 | Telco | White/Slate |
| 6 | 13 | Telco | Blue/Red | 31 | 13 | Telco | Red/Blue |
| 7 | 13 | Telco | Orange/Red | 32 | 13 | Telco | Red/Orange |
| 8 | 13 | Telco | Green/Red | 33 | 13 | Telco | Red/Green |
| 9 | 14 | Telco | Brown/Red | 34 | 14 | Telco | Red/Brown |
| 10 | 14 | Telco | Slate/Red | 35 | 14 | Telco | Red/Slate |
| 11 | 14 | Telco | Blue/Black | 36 | 14 | Telco | Black/Blue |
| 12 | 14 | Telco | Orange/Black | 37 | 14 | Telco | Black/Orange |
| 13 | 15 | Telco | Green/Black | 38 | 15 | Telco | Black/Green |
| 14 | 15 | Telco | Brown/Black | 39 | 15 | Telco | Black/Brown |
| 15 | 15 | Telco | Slate/Black | 40 | 15 | Telco | Black/Slate |
| 16 | 15 | Telco | Blue/Yellow | 41 | 15 | Telco | Yellow/Blue |
| 17 | 13 | Telco | Orange/Yellow | 42 | 13 | Telco | Yellow/Orange |
| 18 | 13 | Telco | Green/Yellow | 43 | 13 | Telco | Yellow/Green |
| 19 | 13 | Telco | Brown/Yellow | 44 | 13 | Telco | Yellow/Brown |
| 20 | 13 | Telco | Slate/Yellow | 45 | 13 | Telco | Yellow/Slate |
| 21 | 13 | Recv Audio Hi | Blue/Violet | 46 | 13 | Recv Audio Lo | Violet/Blue |
| 22 | 13 | Xmit Audio Lo | Orange/Violet | 47 | 13 | Xmit Audio Hi | Violet/Orange |
| 23 | 14 | Recv Audio Hi | Green/Violet | 48 | 14 | Recv Audio Lo | Violet/Green |
| 24 | 14 | Xmit Audio Lo | Brown/Violet | 49 | 14 | Xmit Audio Hi | Violet/Brown |
| 25 | | Chassis GND | Slate/Violet | 50 | | Chassis GND | Violet/Slate |

[1] "-" means no connection
[2] "Telco" means that the signal is used by telco card slots.
[3] If radio transmitters are remote tone-controlled, just audio signals TX AUDIO HI/LO are necessary. Therefore, connector J20 can handle five telco lines and two tone-controlled radios.
[4] The table shows the pins in numeric order, as they appear when looking directly at the connector. When looking at them on a punch-down block, you need to remember that the first pin on a punch-down block is pin 26, the second pin is 1, etc. Refer to the punch-down block diagram on page 129.

## Model 2200 Backplane Radio Pinouts (702-9071 Rev C - J21)

| J21 Pin | Card Slot | Signal Name | Wire Color Main/Stripe | J21 Pin | Card Slot | Signal Name | Wire Color Main/Stripe |
|---|---|---|---|---|---|---|---|
| 1 | 13 | Recv Audio Hi | Blue/White | 26 | 13 | Recv Audio Lo | White/Blue |
| 2 | 13 | DIG Mode | Orange/White | 27 | 13 | Xmit Request | White/Orange |
| 3 | 13 | Xmit Audio Hi | Green/White | 28 | 13 | Xmit Audio Lo | White/Green |
| 4 | 13 | COR/CAS | Brown/White | 29 | 13 | BUSY | White/Brown |
| 5 | 13 | Ground | Slate/White | 30 | 13 | DIG Data | White/Slate |
| 6 | 13 | ANA PTT COM | Blue/Red | 31 | 13 | ANA PTT NO | Red/Blue |
| 7 | 13 | ANA PTT NC | Orange/Red | 32 | 13 | DIG PTT NC | Red/Orange |
| 8 | 13 | DIG PTT COM | Green/Red | 33 | 13 | DIG PTT NO | Red/Green |
| 9 | 13 | Zone ADR 8 | Brown/Red | 34 | 13 | Zone ADR 4 | Red/Brown |
| 10 | 13 | Zone ADR 2 | Slate/Red | 35 | 13 | Zone ADR 1 | Red/Slate |
| 11 | 13 | AUX NO | Blue/Black | 36 | 13 | AUX NC | Black/Blue |
| 12 | 13 | AUX COM | Orange/Black | 37 | | Chassis GND | Black/Orange |
| 13 | 14 | Recv Audio Hi | Green/Black | 38 | 14 | Recv Audio Lo | Black/Green |
| 14 | 14 | DIG Mode | Brown/Black | 39 | 14 | Xmit Request | Black/Brown |
| 15 | 14 | Xmit Audio Hi | Slate/Black | 40 | 14 | Xmit Audio Lo | Black/Slate |
| 16 | 14 | COR/CAS | Blue/Yellow | 41 | 14 | BUSY | Yellow/Blue |
| 17 | 14 | Ground | Orange/Yellow | 42 | 14 | DIG Data | Yellow/Orange |
| 18 | 14 | ANA PTT COM | Green/Yellow | 43 | 14 | ANAPTT NO | Yellow/Green |
| 19 | 14 | ANA PTT NC | Brown/Yellow | 44 | 14 | DIG PTT NC | Yellow/Brown |
| 20 | 14 | DIG PTT COM | Slate/Yellow | 45 | 14 | DIG PTT NO | Yellow/Slate |
| 21 | 14 | Zone ADR 8 | Blue/Violet | 46 | 14 | Zone ADR 4 | Violet/Blue |
| 22 | 14 | Zone ADR 2 | Orange/Violet | 47 | 14 | Zone ADR 1 | Violet/Orange |
| 23 | 14 | AUX PTT NO | Green/Violet | 48 | 14 | AUX PTT NC | Violet/Green |
| 24 | 14 | AUX PTT COM | Brown/Violet | 49 | | Chassis GND | Violet/Brown |
| 25 | | Chassis GND | Slate/Violet | 50 | | Chassis GND | Violet/Slate |

[1] When the Model 2200 is equipped with a remote control option (950-9074 or 950-9133), TX Audio and RX Audio signals may be obtained from backplane connector J20. In these cases, you do not need to use connector J21.

[2] The table shows the pins in numeric order, as they appear when looking directly at the connector. When looking at them on a punch-down block, you need to remember that the first pin on a punch-down block is pin 26, the second pin is 1, etc. Refer to the punch-down block diagram on page 129.

## Model 2200 Backplane Radio Pinouts (702-9071 Rev C - J22)

| J22 Pin | Card Slot | Signal Name | Wire Color Main/Stripe | J22 Pin | Card Slot | Signal Name | Wire Color Main/Stripe |
|---|---|---|---|---|---|---|---|
| 1 | 15 | Recv Audio Hi | Blue/White | 26 | 15 | Recv Audio Lo | White/Blue |
| 2 | 15 | DIG Mode | Orange/White | 27 | 15 | Xmit Request | White/Orange |
| 3 | 15 | Xmit Audio Hi | Green/White | 28 | 15 | Xmit Audio Lo | White/Green |
| 4 | 15 | COR/CAS | Brown/White | 29 | 15 | BUSY | White/Brown |
| 5 | 15 | Ground | Slate/White | 30 | 15 | DIG Data | White/Slate |
| 6 | 15 | ANA PTT COM | Blue/Red | 31 | 15 | ANA PTT NO | Red/Blue |
| 7 | 15 | ANA PTT NC | Orange/Red | 32 | 15 | DIG PTT NC | Red/Orange |
| 8 | 15 | DIG PTT COM | Green/Red | 33 | 15 | DIG PTT NO | Red/Green |
| 9 | 15 | Zone ADR 8 | Brown/Red | 34 | 15 | Zone ADR 4 | Red/Brown |
| 10 | 15 | Zone ADR 2 | Slate/Red | 35 | 15 | Zone ADR 1 | Red/Slate |
| 11 | 15 | AUX NO | Blue/Black | 36 | 15 | AUX NC | Black/Blue |
| 12 | 15 | AUX COM | Orange/Black | 37 | | Chassis GND | Black/Orange |
| 13 | 16 | Recv Audio Hi | Green/Black | 38 | 16 | Recv Audio Lo | Black/Green |
| 14 | 16 | DIG Mode | Brown/Black | 39 | 16 | Xmit Request | Black/Brown |
| 15 | 16 | Xmit Audio Hi | Slate/Black | 40 | 16 | Xmit Audio Lo | Black/Slate |
| 16 | 16 | COR/CAS | Blue/Yellow | 41 | 16 | BUSY | Yellow/Blue |
| 17 | 16 | Ground | Orange/Yellow | 42 | 16 | DIG Data | Yellow/Orange |
| 18 | 16 | ANA PTT COM | Green/Yellow | 43 | 16 | ANAPTT NO | Yellow/Green |
| 19 | 16 | ANA PTT NC | Brown/Yellow | 44 | 16 | DIG PTT NC | Yellow/Brown |
| 20 | 16 | DIG PTT COM | Slate/Yellow | 45 | 16 | DIG PTT NO | Yellow/Slate |
| 21 | 16 | Zone ADR 8 | Blue/Violet | 46 | 16 | Zone ADR 4 | Violet/Blue |
| 22 | 16 | Zone ADR 2 | Orange/Violet | 47 | 16 | Zone ADR 1 | Violet/Orange |
| 23 | 16 | AUX PTT NO | Green/Violet | 48 | 16 | AUX PTT NC | Violet/Green |
| 24 | 16 | AUX PTT COM | Brown/Violet | 49 | | Chassis GND | Violet/Brown |
| 25 | | Chassis GND | Slate/Violet | 50 | | Chassis GND | Violet/Slate |

[1] When the Model 2200 is equipped with a remote control option (950-9074 or 950-9133), TX Audio and RX Audio signals may be obtained from backplane connector J19. In these cases, you do not need to use connector J22.

[2] The table shows the pins in numeric order, as they appear when looking directly at the connector. When looking at them on a punch-down block, you need to remember that the first pin on a punch-down block is pin 26, the second pin is 1, etc. Refer to the punch-down block diagram on page 129.

# Station Card Removal/Installation

Should it be necessary to remove/install a station card in the paging terminal, use the following procedure.

♦ **Removing/installing a station card**

1. Remove the front cover.
2. Turn off the AC power.
3. Pull on the two black, nylon, retainer latches and gently wiggle the card out of its sockets. Slide the card out of the card-cage and place it on anti-static foam.

**Note** Be sure to set the Address Switches on the replacement card to the same as those on the card removed from the card cage. If slot was empty, see chart of switch settings below.

4. Slide the new card into the card cage.
5. Make sure that the nylon latches are extended toward you. Otherwise, the card edge connectors will not plug in. Push on the card faceplate to fully seat the card into the card cage. Then push on the nylon latches to lock the card into place.
6. Turn on the AC power. After about 30 seconds, you should see the SELECT lights on each card begin to blink as the CPU loads software into each card. The configuration files in the terminal need to be updated by Zetron in order for the terminal to recognize a new card(s).

## Switch Settings

The switches on the station card 702-9038 should be set to match the card cage slot number that the card is installed in. Station cards may be installed into Model 2200: slots 15 and 16 in backplane 702-9071 Rev A, B or slots 13 through 16 for 702-9071 Rev B and C. On the Model 2100, you have two slots to work with; 9 and 10. The following table shows the switch settings.

*Table 9: Station Card Switch Settings*

| Switches | Card Slots | | | | | |
|---|---|---|---|---|---|---|
| | 9[1] | 10[1] | 13[2] | 14[2] | 15 | 16 |
| 1 | B | A | B | A | B | A |
| 2 | A | B | A | B | B | A |
| 3 | A | A | B | B | B | A |
| 4 | B | B | B | B | B | A |
| 5 | A | A | A | A | A | B |
| 6 | A | A | A | A | A | A |
| 7 | A | A | A | A | A | A |
| CRT | A | A | A | A | A | A |

[1] Model 2100 slots
[2] Model 2200 with rev B and C backplane

## Jumper Settings

### Old Station Card

The jumpers on the old station card (Part No. 702-9038) are used as shown in the following table.

*Table 10: Jumper Positions for Station Card 702-9038*

| Jumper | Purpose | Settings Available |
|---|---|---|
| JP1 | Voice audio to Tx | A[1] = flat frequency audio<br>B = pre-emphasized (boost high frequencies) |
| JP2 | Not used | |
| JP3 | Not used | |
| JP4 | Not used | |
| JP5 | Tone audio to Tx | A[1] = flat frequency audio<br>B = de-emphasized (cut high frequencies) |
| JP6 | Terminal busy polarity | A[1] = grounded circuit is busy<br>B = open circuit is busy |
| JP7 | COR busy polarity | A[1] = grounded circuit is busy<br>B = open circuit is busy |

[1] factory setting (unless you specify otherwise)
If your Tx has built-in pre-emphasis, then set JP1 to A and JP5 to B.
If your Tx has flat frequency audio, then set JP1 to B and JP5 to A.

### New Station Card

The jumpers on the new station card (Part No. 702-9441) are used as shown in the following table.

*Table 11: Jumper Positions for Station Card 702-9441*

| Jumper | Purpose | Settings Available |
|---|---|---|
| JP1 | Tone Audio to TX | A[1] = flat frequency audio<br>B = de-emphasized (cut high frequencies) |
| JP2 | Talkback / Tone | A[1] = Talkback audio path enabled<br>B = Tone output connected |
| JP3 | Voice Audio to TX | A[1] = flat frequency audio<br>B = pre-emphasized (boost high frequencies) |
| JP4 | Voice Audio to RX | A[1] = flat frequency audio<br>B = de-emphasized (cut high frequencies) |
| JP5 | COR busy polarity | A = open circuit is busy<br>B[1] = grounded circuit is busy |
| JP6 | Terminal Busy Polarity | A = open circuit is busy<br>B[1] = grounded circuit is busy |
| JP7 | | Must be OUT |

[1]factory setting (unless you specify otherwise)
If your Tx has built-in pre-emphasis, then set JP3 to A and JP1 to B
If your Tx has flat frequency audio, then set JP3 to B and JP1 to A

If you wish to cross busy your terminal with another terminal at your site or with another terminal on your RF frequency, call the Zetron Technical Support at (425) 820-6363 for help.

## Station Card Adjustments

Each radio station interface card has three adjustments:

- **XMIT AUDIO** level to the transmitter
- **XMIT TONE** level to the transmitter
- **RECV AUDIO** from the receiver

Please note the **XMIT AUDIO** adjusts the PCM audio playback level, which normally carries recorded voice. The **XMIT TONE** level adjusts the signaling tones and link modem (option). **RECV AUDIO** is used only for the Talkback option.

The digital paging level has no adjustments on the Zetron interface card. Channel deviation for digital paging is set on the particular RF transmitter.

Two different adjustment procedures are used, depending upon whether the paging transmitter is located over a remote line or not.

For a Zetron 2100 or 2200 co-located with the transmitter at the RF site, you can perform all of the adjustments yourself.

### ♦ Adjusting a co-located transmitter

1. Tune your communications monitor to the desired paging frequency, and page a 2-tone or 5/6-tone tone & voice pager.
2. During the voice time, adjust the **XMIT AUDIO** to 3.5 kHz to 4.2 kHz RF deviation.
3. During the paging tones adjust the **XMIT TONE** level to obtain 3.5 kHz to 4.0 kHz channel deviation.
4. Page a POCSAG or GSC binary digital pager.
5. During the signaling time, adjust the transmitter digital deviation to 4.5kHz to 5.0kHz.
6. Try some pagers with a variety of paging tones; from 500 Hz to 2500 Hz. Make sure that your transmitter deviation is *NOT* dependent upon the paging tone frequencies. If it is, the pagers will not reliably decode, and the voice messages will sometimes sound distorted. (See Jumper Settings for ways to make the audio "flat").

For a remote transmitter site, it helps to have two people, one at each location. The person at the transmitter site would normally have the communications monitor. You will need to adjust the levels sent through the control link as well as the RF deviation levels.

### ♦ Adjusting a remote transmitter

1. Using an AC-VRMS voltmeter or oscilloscope at the transmitter site, measure the link audio level being received at the transmitter control shelf equipment.
2. Page a tone & voice pager and adjust the **XMIT TONE** and **XMIT AUDIO** levels so that the link levels are in the range required by the link control equipment.
3. Page a digital pager and make sure that the link modem tones are at the desired level.
4. Finally, adjust the RF transmitter tone deviation to +3.5kHz and digital deviation to +/-4.5kHz.

# Radio Signal Descriptions

| Signal Name | Purpose |
|---|---|
| RECV AUDIO HI & LO | Input audio from radio receiver 600W balanced audio, transformer coupled (for talkback and 2-way) |
| DIG MODE | Output tells radio to key up in digital mode, RS-232 voltage level, polarity set in oparam.cds file |
| XMIT REQUEST | Output indicates terminal would like to use radio, RS-232 voltage level, polarity set in oparam.cds file |
| XMIT AUDIO HI & LO | Output audio to radio transmitter (tone/voice/modem) 600W balanced audio, transformer coupled |
| COR/CAS | Input from radio, keeps paging terminal from using radio transmitter until "channel is clear" Usually connected to radio **COR** or **CAS** signal. Also can be used as Clear to Send Analog input from a TX link controller such as PURC PSC/SSC TTL, RS-232, CMOS level compatible. Jumper selected polarity. |
| BUSY | Input from other paging equipment sharing the radio, keeps paging terminal from using radio transmitter. Paging terminal will stop transmitting at end of current paging batch if other equipment requires radio. Also can be used as Clear to Send Digital input from a TX link controller such as PURC PSC/SSC TTL, RS-232, CMOS level compatible. Jumper selected polarity. |
| GROUND | Signal ground, used with signals **DIG MODE**, **XMIT REQUEST**, **COR/CAS**, **BUSY**, **DIG DATA**, **ZONE ADR 1/2/4/8**. Not the same as chassis ground. |
| DIG DATA | Output carries binary-digital paging data RS-232 voltage level. Programmable polarity in oparam.cds file. See *Modifications for TTL Data Signal Levels* on page 111, for advice on converting output signal to TTL levels. |
| ANA PTT COM/NO/NC | Output indicates analog paging audio is being sent to the radio transmitter. Also can be used as Request to Send Analog output to a TX link controller such as PURC PSC/SSC. Relay contacts rated 30 Volts AC/DC, 1 amp or 120 VAC, 0.5 amp. |
| DIG PTT COM/NO/NC | Output indicates digital paging data is being sent to the radio transmitter. Also can be used as Request to Send Digital output to a TX link controller such as PURC PSC/SSC. Relay contacts rated 30 Volts AC/DC, 1 amp or 120 VAC, 0.5 amp. |
| ZONE ADR 8/4/2/1 | Outputs indicate radio RF paging zone selected, along with **XMIT REQUEST** to look at whether selected zone is busy or clear on **XMIT REQUEST**. Zone is coded in binary bits 8, 4, 2, and 1. (example: 8/4/2/1 = On/Off/Off/On is Zone #9) Each signal is open collector with pull-up resistors to 5 volts; able to sink 40 mA to signal ground to drive relays or a TX link controller. Signal from zero to 0.8VDC, means logic "1" (On). |

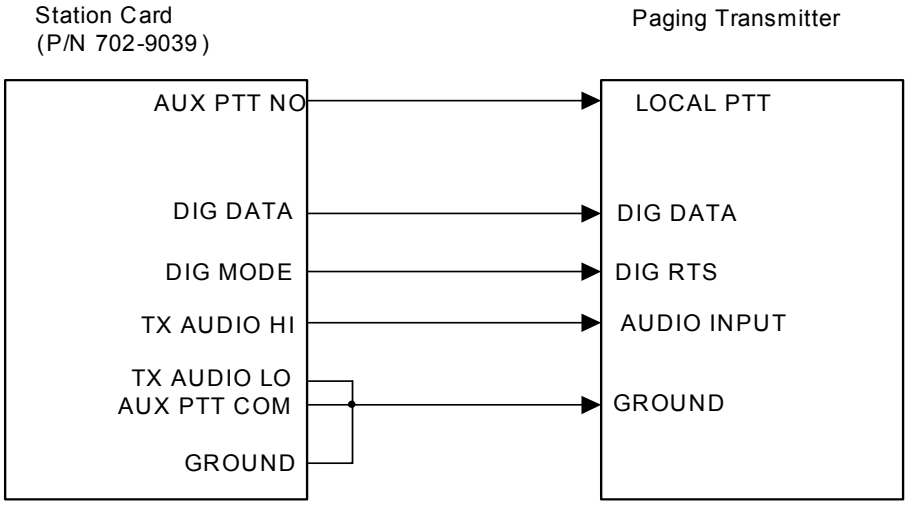
| Signal Name | Purpose |
|---|---|
| AUX COM/NO/NC | Extra outputs activate after **XMIT REQUEST** and before **ANA PTT** or **DIG PTT**. Useful as "busy" output to other control equipment sharing the radio transmitter. Relay contacts rated 30 Volts AC/DC, 1 amp or 120 VAC, 0.5 amp. |
| CHASSIS GND | Connected to protective chassis ground for cable shielding and RFI protection. Not the same as signal ground. |

[1] RS-232 levels: -3V to -12V DC = logic "0" +3V to +12V DC = logic "1"
[2] TTL levels: 0 to 0.8V DC = logic "0" 2.4 to 5.0V DC = logic "1"
[3] CMOS levels: same as TTL above, except no pull-up resistor load

## Co-located Radio Station

Direct cable hookup between the Zetron station card (702-9038) and a co-located radio transmitter is used most often for local area paging such as in hospitals and industrial plants. Such a transmitter can be a General Electric MASTR II that can even do digital paging using a GE modulator conversion kit. The cable hookup depends upon the particular radio station, but Figure 18 provides a basic guide.

*Figure 18: Co-located Radio Stations*



NOTES:

- Set the polarity for DIG DATA and DIG MODE in the file oparam.cds (full details on software settings can be found in *System Configuration Files* on page 217). Typical settings are shown in the following table.

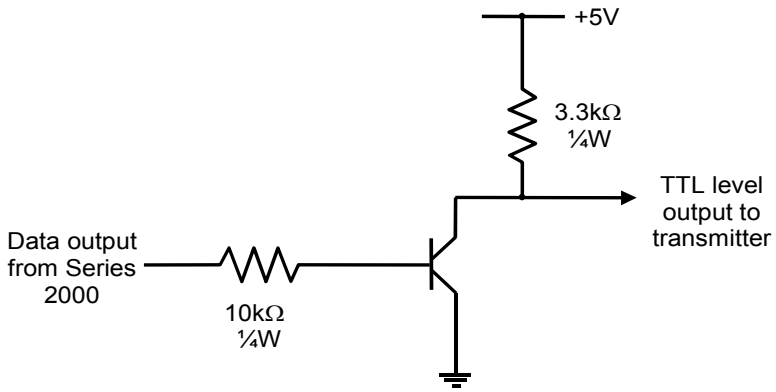
| pp | Meaning | cc | qq ... |
|---|---|---|---|
| 05 | Mode signal polarity | 02 | 01 = high value for digital page |
| 06 | Digital data polarity | 02 | 00 = inverted data |

- Various timing parameters such as PTT keying and analog/digital settling delay are settable in the oparam.cds configuration file.

## Modifications for TTL Data Signal Levels

In some applications, RS-232 data signal levels are not desired for radio station connections. If either the DIG DATA or DIG MODE signals from the paging terminal need to be converted to TTL data signal levels, the circuit shown in Figure 19 may be inserted between the paging terminal and the radio transmitter input.

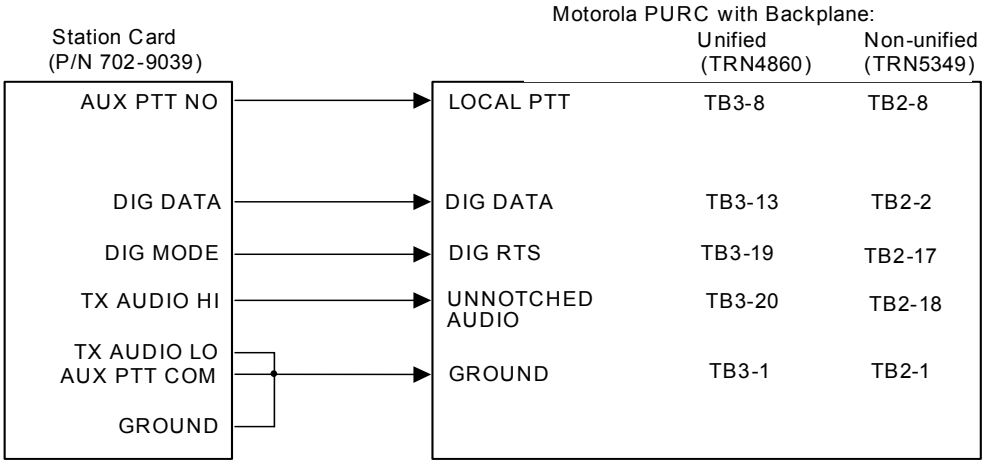
*Figure 19: RS-232 to TTL Data Level Conversion*



# Co-located Motorola PURC Station

Direct cable hookup between the Zetron station card (702-9038) and a co-located Motorola PURC radio transmitter is shown in Figure 20. The cable hookup depends upon whether the PURC has a “Unified” or “Non-Unified” backplane. The Motorola pin numbers refer to backplane terminal blocks.

*Figure 20: Co-located PURC Stations*




NOTES:

- Set the polarity for DIG DATA and DIG MODE to inverted (0 Vdc = logic “1”) in the file oparam.cds (full details on software settings can be found in *System Configuration Files* on page 217).

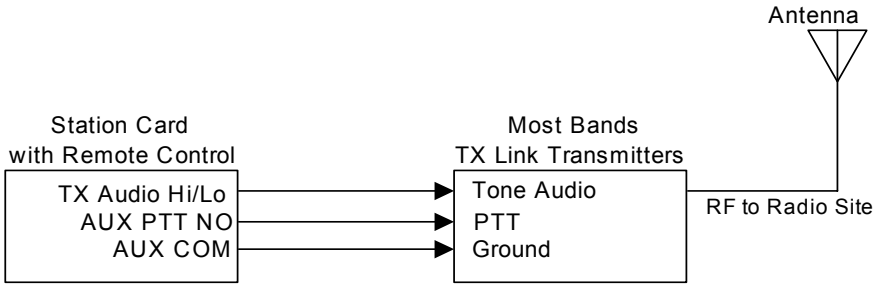
| pp | Meaning | cc | qq ... |
|---|---|---|---|
| 05 | Mode signal polarity | 02 | 01 = high value for digital page |
| 06 | Digital data polarity | 02 | 00 = inverted data |

- Disconnect UDS 202 modem built into the Motorola PURC if so equipped.

# Remote Control Options (950-9074 and 950-9111)

Most radio stations for wide area paging are located at a distance from a Zetron 2000 Series Paging Terminal. Consequently, the station card (702-9038) can be equipped with options for Single Site Remote Control (950-9074) or Multiple Site Remote Control (950-9111). These remote control options are compatible with Motorola PURC transmitter control shelf equipment or a Zetron Model 66 Transmitter Control Panel. When so equipped, the Zetron station card can directly drive a dedicated line or link transmitter with just a few wires:

*Figure 21: Generic Link Transmitter Interface*




NOTES:

- *IMPORTANT*: AUX PTT must be used to key link transmitter. ANA PTT and DIG PTT are not asserted soon enough resulting in a missed HLGT*.
- On the Zetron Model 2200 Expanded Backplane and all Model 2100's, the TX audio outputs appear on extra connectors to save on connector wiring (see *Radio Connectors* on page 98).
- Following are typical parameters for controlling a Zetron Model 66 transmitter controller or a Motorola PURC transmitter via remote control (refer to *System Configuration Files* on page 217 for details on this):

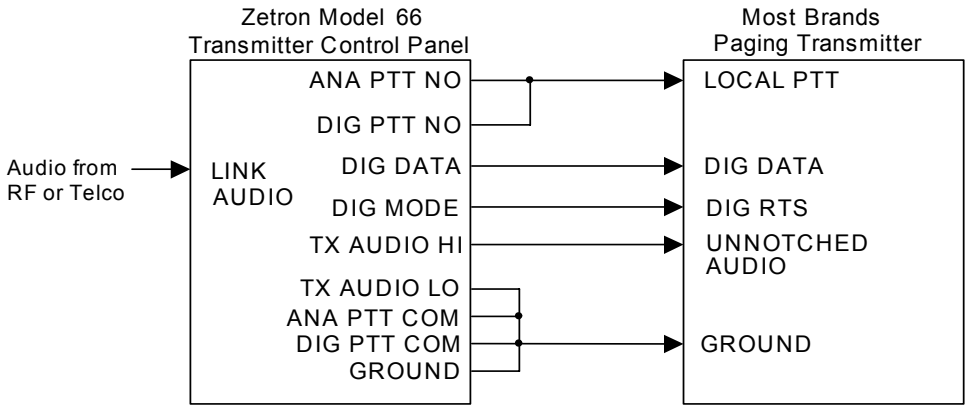
| pp | Meaning | cc | qq ... |
|---|---|---|---|
| 07 | PURC remote control mode | 02 | 02 |
| 04 | TMOD - Mode switch time | 03 | 00 64 = 100ms |
| 02 | TKEY - Keyup time | 03 | 01 A4 = 420ms HLGT* |
| 06 | Digital Data Polarity | 02 | 00 = inverted |

* HLGT is High Level Guard Tone. The value of 420ms is typical; figure it as 120ms, plus 300ms per RF link delay. Thus, if your signal went through two tone-keyed RF links, you would set it to 720ms.

## Zetron Model 66 Transmitter Control Panel

At the radio site, a Zetron Model 66 Transmitter Control Panel provides the remote control receiver for both analog and digital paging control of the paging transmitter. The Model 66 is compatible with transmitters from Quintron, General Electric, Glenayre, Neutec, Spectrum, and a host of others. Direct cable hookup between the Model 66 and the radio is straightforward.

*Figure 22: Zetron Model 66 Transmitter Control Panel*




NOTES:

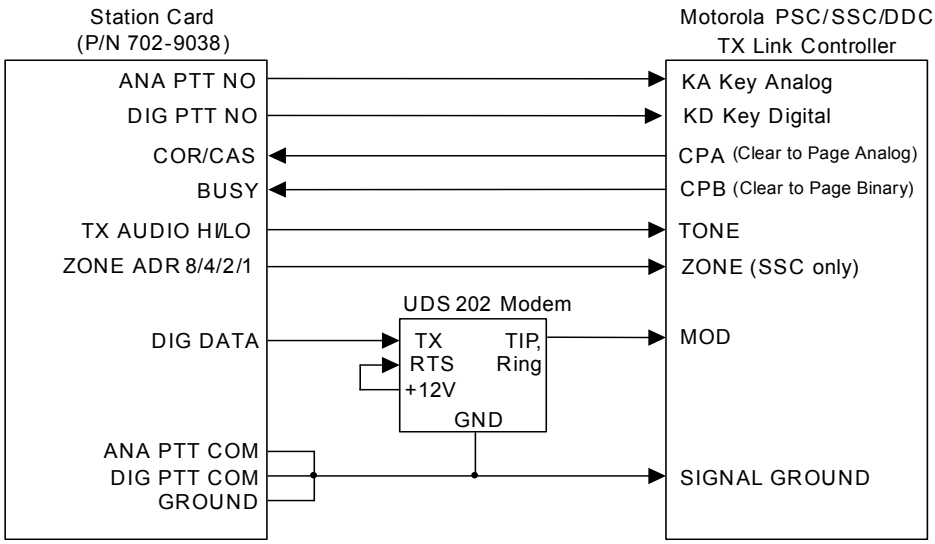
- Set the polarity for DIG DATA and DIG MODE with jumpers in the Model 66. Other jumpers and switch settings select site address and keying tone frequencies.
- Setting jumper JP5 in the Model 66 to the “A” position will force the Model 66 to use the analog PTT output for all pages. Setting the jumper JP5 to the “B” position allows the Model 66 to use either the analog or the digital PTT output, whichever is appropriate for the page.

Refer to the note under *Remote Control Options (950-9074 and 950-9111)* on page 113 for typical parameter settings.

## Motorola PSC/SSC/DDC Controller

Typical cable hookup between the Zetron station card (702-9441) and a Motorola PURC Station Controller (PSC) or Simulcast System Controller (SSC) is shown below. Please note that a Motorola PSC or SSC requires an external 202-type modem to encode the digital paging data. Use of a Motorola PSC can be replaced by Zetron's remote control option (950-9074) and some Motorola SSC applications by option (950-9111) for the radio station interface card.

*Figure 23: Motorola PSC/SSC Connections*




NOTES:

- Zone outputs from Zetron are active low (0 VDC = logic “1”)
- The following settings are typical in the oparam.cds file (see *System Configuration Files* on page 217)

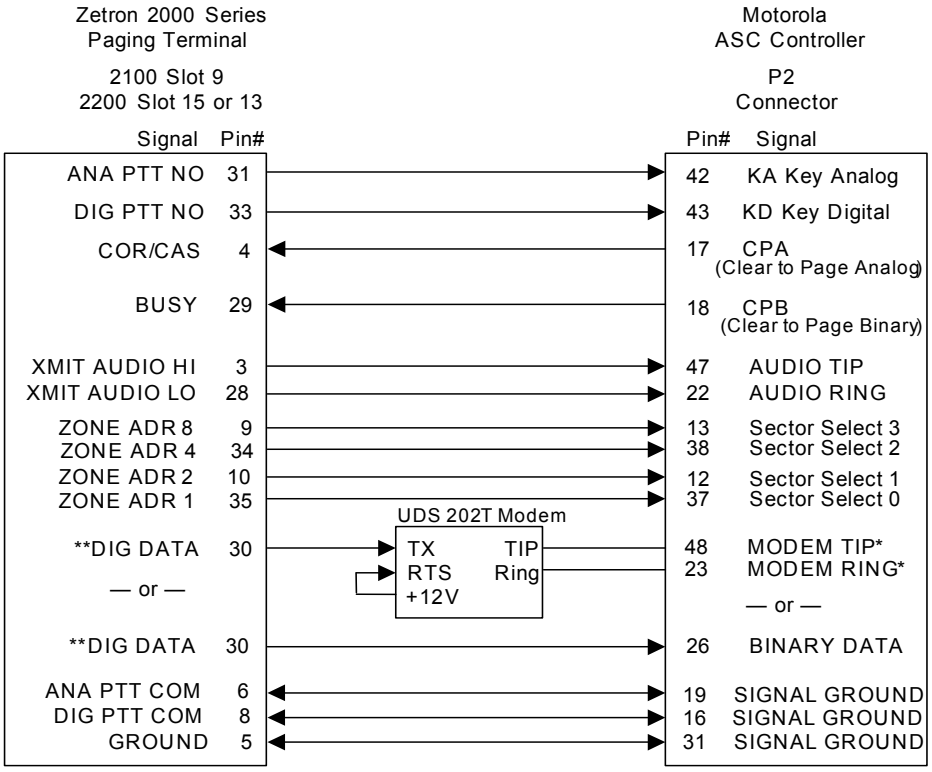
| Meaning | cc | pp | qq ... |
|---|---|---|---|
| Busy time | 03 | 01 | 00 19 = 25 milliseconds that COR/CAS must be clear |
| Mode switching time | 03 | 04 | 00 32 = 50 milliseconds to wait between changes in PTT relays |
| Mode signal polarity | 02 | 05 | 00 = low value for digital page |
| Digital data polarity | 02 | 06 | 00 = inverted data |
| Remote control mode | 02 | 07 | 04 = External TX-controller RTS/CTS handshaking |

- Line Out signals from the Motorola PSC/SSC drive the link.
- Install/troubleshooting notes:
  - Make sure the modem is a 202, not a 212.
  - Idle state: COR & BUSY LEDs should be lit when not paging; change station card jumpers JP6 and JP7 as needed.

- If an SSC is not working, check that its CPA line jumper is set for CPA to CPA, not CPA to CPB.

## Motorola ASC (Advanced Simulcast Controller)

*Figure 24: Interfacing to Motorola Advanced Simulcast Controller*




* If the ASC has an internal modem option, you would not use the 202T, and would cross-wire MODEM TIP to AUDIO TIP, and MODEM RING to AUDIO RING.

** At the time we tested with the ASC, it would not accept direct binary data input, so required the external modem. We show both methods here.

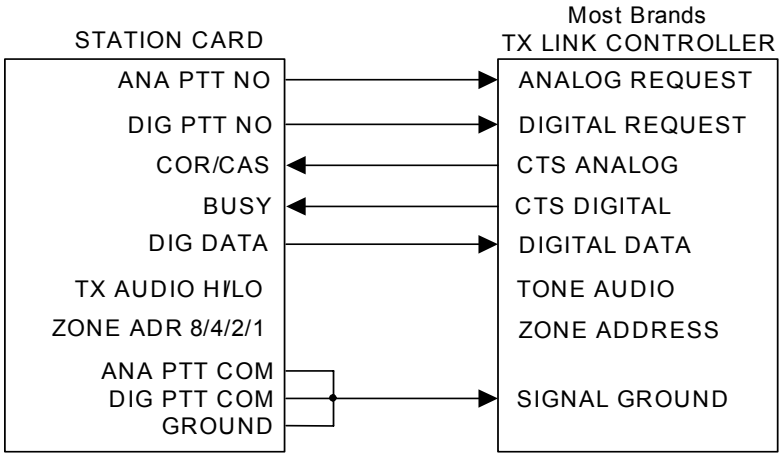
Refer to the ASC Service Manual and Installation Guide for the P2 connector pinout.

Please note that the zoning (Sector Select on ASC) is an option on the ASC. The parameter settings are the same as for the PSC/SSC/DDC on the previous page, but parameter 06 (digital data polarity) may need to be inverted.

## TX Link Controllers

Typical cable hookup between the Zetron station card (702-9441) and most brands of transmitter link controllers such as Quintron Omega, Microlink 20T, and Motorola DDC is shown below. For Motorola PSC or SSC TX link controller, see hookup in a previous diagram.

*Figure 25: TX LINK Controllers*



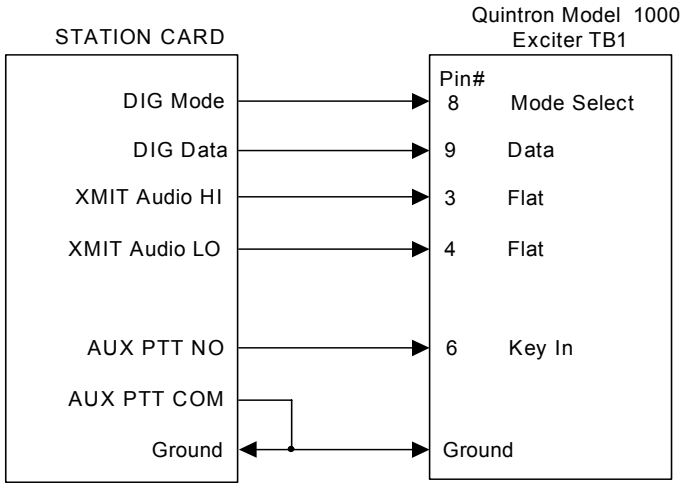

NOTES:

- Zone outputs from Zetron are active low (0 VDC = logic “1”)
- Normal polarity for COR/CAS and BUSY are 0 VDC = logic “1”. LED should be on when idle. If opposite polarities are desired, move jumpers JP5 and JP6 on the station card (702-9441) to position A.
- The following timing settings are typical in the file oparam.cds (full details on software settings can be found in *System Configuration Files* on page 217).

| pp | Meaning | cc | qq ... |
|---|---|---|---|
| 01 | Busy time | 03 | 00 19 = 25 milliseconds that COR/CAS must be clear |
| 04 | Mode switching time | 03 | 00 32 = 50 milliseconds to wait between changes in PTT relays |
| 07 | Remote control mode | 02 | 04 = External TX-controller RTS/CTS handshaking |

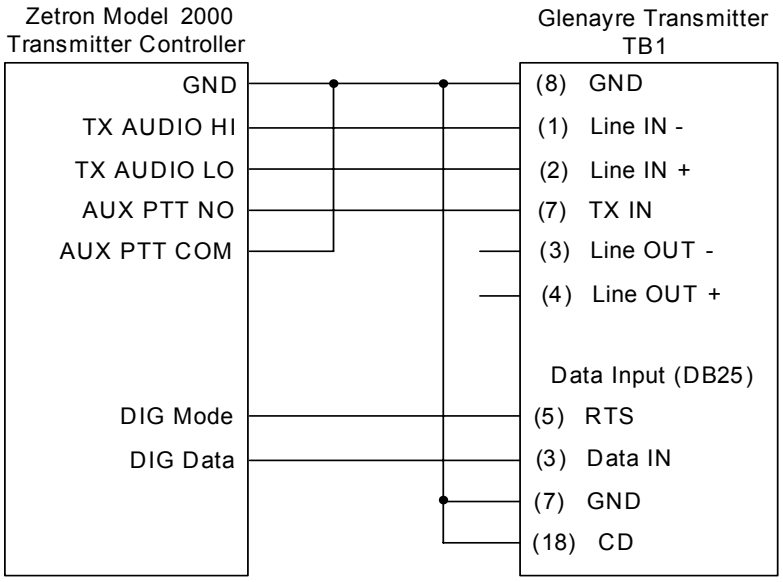
## Quintron 1000 Exciter Hookup

*Figure 26: Interface to the Quintron 1000*




## Connecting Zetron 2000 Series to Glenayre Transmitter

*Figure 27: Interface to a Glenayre Transmitter*




NOTES:

- The digital mode signal will need to be inverted via oparam.cds modification. If digital pagers do not alert but the transmitter keys, try inverting digital data signal also via oparam.cds modification.

# Multiport Serial TAP Input

## Overview

The Multiport Serial Card allows serial communications with a 2000 Series paging terminal. There are two basic uses for this card.

The first use is alphanumeric page entry from up to eight separate serial inputs. The card is hooked up to alpha entry devices with a serial port, using either our dumb-terminal mode or iXO (TAP) paging protocol.

The other use is as a TNPP interface. Refer to *Multiport for TNPP and TAP Outdial* on page 133, for more information.

### Paging Terminal Requirements for the Multiport Card

You must be using Version 300 or later software. Therefore, you must have a CPU in the terminal with at least 512K of memory. The version of the ZPAGE program running the terminal must be 300d0 or later.

If you have a Model 2200, it must have Revision B or later lower backplane (ZBUS, 702-9071). A Revision A backplane will not work due to different analog grounds. (This can be worked around by cutting a trace on the Multiport card.)

### General Information

You can purchase the Multiport card in a 2-, 4-, 6-, or 8-port configuration.

Each serial port is independent of the others, just as each half of a Dual Trunk card is independent.

For more information on alphanumeric messaging, refer to the Alphanumeric Messaging section of the 2000 Series Operating and Programming Manual (025-9034-001).

For detailed information on the iXO/TAP protocol, refer to *Appendix A: TAP Protocol Summary* on page 361.

For information on TNPP networking, please refer to *Multiport for TNPP and TAP Outdial* on page 133.

## Option Details

The Multiport option consists of a Multiport card (marked **2000 Series Multiport** on the front of the card), and software. A brief listing of the components includes:

- This document
- The Multiport software (usually transferred via modem to your paging terminal)
- The Multiport option hardware (950-9196) consisting of:

| Qty | PN | Description |
|---|---|---|
| 1 | 702-9191 | Multiport board, 2-port configuration |
| x | 950-9197 | Additional ports to make 4, 6, or 8 ports total (already installed on the Multiport board) |
| 1 | 709-0006 | 50-conductor ribbon cable/connector assembly |
| 1 | 709-0004 | 50-conductor round cable |
| 1 | 802-0093 | Punch-down block |
| 1 | — | Set hardware: 2 mtg. studs (250-0105) & 2 screws (220-0108) |

## ZbaseW

If you received a major software or hardware update with this Multiport card, we will be working directly with you on updating your system. For instance, updating from version 295 to version 300 takes many steps not outlined here. If you received a Translator disk and instructions, you are doing a major update.

If instead you received a ZbaseW software Update disk (or disks), follow the instructions on the “Office Software Configuration Summary” sheet that came with the disk(s).

Do any ZbaseW updates before proceeding.

# Installation and Configuration

## General

Please call us when you are ready to install the card.

> **Warning!** Never insert or remove a card in a 2000 Series paging terminal without first turning off the power!

Before installing the card, we must decide which slot it will go in, which will determine the setting of the address switches on the upper front of the Multiport card.

The Multiport card goes into any available peripheral slot, just as if you are adding a Trunk or Station card. Typically, it will simply be placed in the next free peripheral slot, somewhere between slots 6 and 10 on a Model 2100, or 7 and 16 on a Model 2200, or 4 and 13 on a Model 2200EX. When you call, we will decide with you on a slot, then tell you how to set the switches to match the slot number (in binary).

Unlike Trunks and Stations, the Multiport card has its own connector - it does not use the existing black connectors on the lower backplane of the paging terminal, instead it uses its own separate blue 50-pin connector assembly.

You can have us configure the software on the paging terminal either before you do the hardware installation, or after. It does not matter as long as the card's address switches are set correctly when installed.

## Information Needed

For software configuration, we need only the following from you:

- The address switch setting for the card, as mentioned previously.
- The serial parameters you want to use - baud rate, word size, and parity.
- A brief description of what you are connecting to.

## Hardware Installation

- Call us with the information called out in the preceding list. We will tell you how to set the switches on the Multiport card. We can do the software update of the paging terminal now, or after you install the hardware.
- Turn power off to paging terminal. Remove the front cover.
- Mount the new blue 50-conductor cable/connector assembly along the lower backplane. You will see that the spacing of two of the screws that hold the lower edge of the backplane to the chassis matches the spacing of the mounting holes on the blue connector. Remove those two screws, and replace them with the supplied

mounting studs. Then mount the blue 50-pin connector to the studs using the supplied screws.

- Run the blue cable up between the plastic card guides of the Multiport card's slot and the next slot. Pull it through enough so you will be able to plug it into the card easily.
- Attach the rectangular blue cable connector to the mating 50-pin connector at the lower edge of the Multiport board. The blue ribbon cable will hang straight down from the bottom edge of the board when correctly installed. Make sure the connector is not offset left or right.
- Slide the board into its slot. (It may be a bit difficult due to the width of the cable). Secure it with the plastic latches at top and bottom.
- Mount the new punch-down block in your wiring area near the right side of the terminal, near your other telco and radio punch-down blocks.
- Use the supplied double-ended 50-conductor cable to connect the new 50-pin connector to the new punch-down block.

Double-check your work.

Turn on power to the terminal.

When you first turn it on, the Chan 1 - Chan 8 lights on the front panel of the Multiport card should show how many ports are installed - 2, 4, 6, or 8. (Once it is running, these lights show activity instead).

You should see the machine boot up as usual. If we have already updated your paging terminal software configuration you should see the Multiport card loaded up, and its Select and Test3 lights should flash like the other cards. If the software has not been updated, the card will just sit there - call us to do the software update.

## Connections

Refer to the Figure 29 on page 128 for connection of serial devices to the punch-down block.

To hook up to most equipment, you will need to provide a DB-25P (male) connector, and some wire - 26 gauge (or sometimes 24 gauge) solid wire is easiest to punch-down. We do not provide these items.

Please note that there is currently NO real use of the handshaking lines on the serial card. Only the Transmit, Receive, and Ground connections are actually used.

## Miscellaneous

If you have an older schematics manual that lacks information on the Multiport card, and want the schematic, please request it from us. For most customers, this is not necessary - we repair problems with cards.

There are two jumpers on the Multiport card, JP1 and JP2. These are not currently used for anything, and should always be left open.

## Software Configuration

We must configure the terminal to be aware of the new card and to set it up properly. We will do this for you. Once set up, the machine will need to be rebooted to recognize the changes.

For your information, the following describes what we currently do. You need not be concerned with this unless you want to be - it is intended for our more technically oriented customers.

> **Note** If you have changed the following parameter files yourself since we last changed them, please make a note to tell us so we do not accidentally wipe out changes you have made.

Add a line to `config.cds` so the card is loaded with software. Example:

```
 13 8 2ser8b2a.img           ; card 13, multiport serial rev. 8b2a
```

Add lines to `oparam.cds` so the card is configured properly. Example:

```
; Multi-Port Serial card 13: (2 ports)
;
; Port 1
0D 00   02   0B   00            ; 300 baud
0D 00   02   0C   00            ; even parity, 7 bits
0D 00   05   09   11 00 00 01   ; serial port, 0 ring, 0 digits, can answer
0D 00   02   0D   00            ; disable transaction messages
0D 00   02   14   1E            ; logon timeout, 30 seconds (0 disables)
; Port 2
0D 01   02   0B   01            ; 1200 baud
0D 01   02   0C   02            ; no parity, 8 bits
0D 01   05   09   11 00 00 01   ; serial port, 0 ring, 0 digits, can answer
0D 01   02   0D   01            ; enable transaction messages
0D 01   02   14   00            ; logon timeout, in seconds (0 disables)
```

Also, update the history section of the `config.cds` and `oparam.cds` files so we know who did what when.

Link up to the terminal and transfer the proper software file (currently `xser8b2a.img`), the `config.cds`, and the `oparam.cds`.

Reboot the machine (turn it off, then on; or issue the “reboot” command in ZlinkW) to activate the changes.

## Multiport Configurations

### 950-9197 - Additional Serial Port Pair

Each one of these options adds two serial ports to the 950-9196 (702-9191 card), by adding a pair of chips to the board. Table 10 shows the four possible configurations.

*Table 12: Multiport Card Serial Port Configurations*

| #Ports | Dual UARTs in (2681, 321-2181) | RS-232 Drivers in (14506, 317-5406) |
|---|---|---|
| 2 (base) | U3 | U1, U2, U8 |
| 4 | U3, U9 | U1, U2, U8, U14 |
| 6 | U3, U9, U16 | U1, U2, U8, U14, U20 |
| 8 | U3, U9, U16, U21 | U1, U2, U8, U14, U20, U15 |

Note that the software needs to be changed to match the hardware, as discussed in the previous section. This affects the image, config.cds, and oparam.cds files. The hardware and software should be updated at the same time.

Observe proper anti-static parts handling precautions when handling the chips.

When you first turn it on, the Chan 1 - Chan 8 lights on the front panel of the Multiport card should show how many ports are installed - 2, 4, 6, or 8. (Once it is running, these lights show activity instead).

## Connecting Multiport Hardware to RS-232 Connectors

There are two basic classes of devices that use serial interfaces such as RS-232C. The two classes are known as DTE and DCE. The first, DTE, stands for *Data Terminal Equipment* and comprises of equipment that functions as a source and/or sink for digital data. This includes computers, data terminals, and printers. The second class is DCE, which stands for *Data Communication Equipment*, and includes devices such as modems, DDS telephone connections, and satellite earth stations.

The primary standard for serial device interconnections is *EIA RS-232-C*, usually shortened to simple RS232. Confusion may arise over the signals presented at the pins of various devices, especially transmit and receive data. This occurs because the signals line functions are referenced to DTE. This means that the TX pin is always pin 2, even though pin 2 on a modem (a DCE) is accepting serial data into the modem.

The pin-outs for the two common RS-232C connector styles are listed in Table 13 and Table 14. An “**I**” after the pin number means that the signal is an input, while an “**O**” means that the signal is an output from the port. Non-signal pins, such as ground, have no letter after the pin number.

*Table 13: Pinout for a 25-pin D-subminiature Connector on DTE (Generally Male)*

| Pin # | Signal Type | Label | Description |
|---|---|---|---|
| 1 | | | Shield Ground |
| 2 | I | TX | Transmit Data |
| 3 | O | RX | Receive Data |
| 4 | O | RTS | Request To Send |
| 5 | I | CTS | Clear To Send |
| 6 | I | DSR | Data Set Ready |
| 7 | | GND | Signal Ground |
| 8 | I | DCD | Data Carrier Detect, Carrier Detect |
| 20 | O | DTR | Data Terminal Ready |
| 22 | I | RI | Ring Indicator |

[1] Pins 9 through 19, 21, and 23 through 25 are Unused

*Table 14: Pinout for 9-pin D-subminiature Connector (IBM Style, Male Connector)*

| Pin # | Signal Type | Label | Description |
|---|---|---|---|
| 1 | I | DCD | Data Carrier Detected, Carrier Detect |
| 2 | I | RX | Receive Data |
| 3 | O | TX | Transmit Data |
| 4 | O | DTR | Data Terminal Ready |
| 5 | | GND | Signal Ground |
| 6 | I | DSR | Data Set Ready |
| 7 | O | RTS | Request To Send |
| 8 | I | CTS | Clear To Send |
| 9 | I | RI | Ring Indicator |

In Table 15 the adapter style listed will connect directly to the named class of devices. A straight through cable, with a male connector at one end and a female at the other, may be used between the adapter and the other device.

*Table 15: Types of Serial Devices, Modes of Operation, and Connections*

| Device | Class | Multiport Serial | TNPP | OutDial TAP |
|---|---|---|---|---|
| Data Terminals (Wyse 30 &ct) | DTE | D | D[1] | D[1] |
| IBM PC compatible serial ports | DTE | A | A Zapp[4] | |
| Modems (103, 212, “Hayes”, 202, packet) | DCE | B | B | C |
| Motorola Alpha-Mate[2] | DTE | B | | |
| “Equatorial” Satellite station[3] | DCE | | C “NetUSA”[4] | |

[1] A TNPP port or an Outdial TAP card may be connected to a CRT for testing purposes.
[2] While the Alpha-Mate is properly a DTE, it is pinned out as a DCE. The Alpha-Mate has a built-in modem that normal would be used for telephone connection to a modem in the paging terminal. The Alpha-Mate's serial port pin-out allows it to plug into a paging terminal in place of an external modem.
[3] The Equatorial interface box has signal pins like a DTE but has a female DB-25 connector like a modem.
[4] TNPP Satellite Option, Part No. 950-9347.

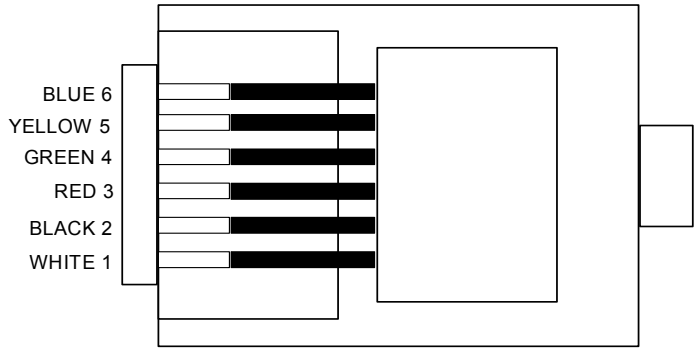
In Table 16, the connector codes map to the pinouts shown in Figure 28. In the column headers of Table 16, the signal name in quotes is the label as it appears on the Zetron schematics. The colors are those of the wires in the RJ-12 jack.

*Table 16: RJ-12 to DB25 Connections*

| Connector type | Gender | Red "GND" | Yellow "RX" | Black "TX" | Blue "CTS" | White "RTS" | Green "GND" |
|---|---|---|---|---|---|---|---|
| A[1] | Female | 1 | 2 | 3 | 4 | 5 | 7 |
| B | Male | 1 | 3 | 2 | 5 | 4 | 7 |
| C | Male | 1 | 3 | 2 | 8 | 20 | 7 |
| D | Male | 1 | 2 | 3 | 4 | 5 | 7 |

[1]Not available at this time.

*Figure 28: Multiport Pinouts*




**2000 SERIES, TNPP OPTION, Part No. 950-9346**

| COLOR | TYPE "B" DB 25 PIN | SIGNAL DESCRIPTION |
|---|---|---|
| RED | 1 | GND |
| BLACK | 2 | TX |
| YELLOW | 3 | RX |
| WHITE | 4 | RTS |
| BLUE | 5 | CTS |
| GREEN | 7 | GND |

**2000 SERIES, OUTDIAL TAP, Part No. 950-9428**
**2000 SERIES, SATELLITE OPTION, Part No. 950-9347**

| COLOR | TYPE "C" DB 25 PIN | SIGNAL DESCRIPTION |
|---|---|---|
| RED | 1 | GND |
| BLACK | 2 | TX |
| YELLOW | 3 | RX |
| GREEN | 7 | GND |
| BLUE | 8 | CD |
| WHITE | 20 | DTR |

**2000 Series, Multiport Option (Part No. 950-9196)**

| COLOR | TYPE "D" DB 25 PIN | SIGNAL DESCRIPTION |
|---|---|---|
| RED | 1 | GND |
| YELLOW | 2 | RX |
| BLACK | 3 | TX |
| BLUE | 4 | CTS |
| WHITE | 5 | RTS |
| GREEN | 7 | GND |

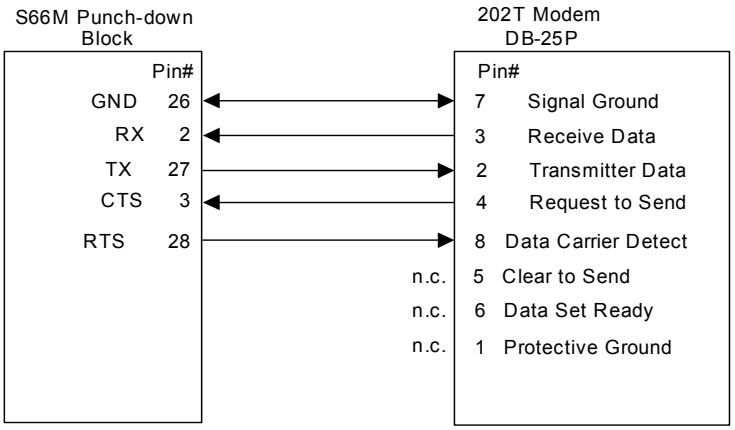
## UDS 202T Modem Hookup Example

**Note** This information is for older systems with a S66M punch-down block.

This is an example of hooking up an external device to the Multiport card. Other equipment may have different pin connections. This is *only* an example.

This shows the connection between our S66M punchdown block (using the first serial port of the Multiport card) and the UDS (Universal Data Systems, a Motorola division) Model 202T Modem.

*Figure 29: UDS 202T Modem Interface*




**Note** Although the CTS and RTS lines are shown connected here, they are not actually used for handshaking. The modem is always active when the Multiport card is active (RTS comes on when card software is active).

### Strap options:

- Strap the Transmit Carrier (RTS) option to the ON position. To prevent ground loops, strap the Chassis/SYS GND option to OUT.
- Other straps do not matter or depend on your particular installation.

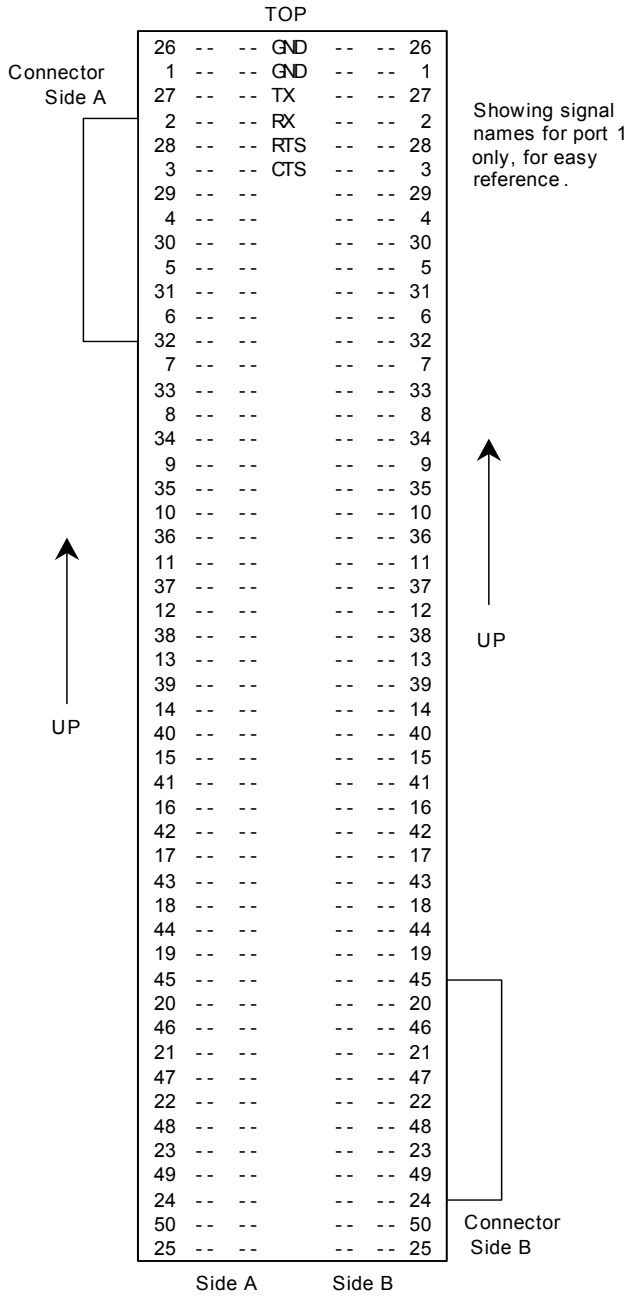
Put the 202T modem's front panel switch in the Data position for operation.

Connect the 4-wire audio leased telephone line to the modem's COMM LINE jack with a properly wired modular plug.

Refer to the UDS 202T manual for further details, and to the following wiring diagrams for any details of the wiring hookup.

**Note** You can use either the "A" or the "B" side of the S66M punchdown block.

## Pinout for the Siemon S66M Punchdown Block




| | | | | | | |
|---|---|---|---|---|---|---|
| 26 | -- | -- | GND | -- | -- | 26 |
| 1 | -- | -- | GND | -- | -- | 1 |
| 27 | -- | -- | TX | -- | -- | 27 |
| 2 | -- | -- | RX | -- | -- | 2 |
| 28 | -- | -- | RTS | -- | -- | 28 |
| 3 | -- | -- | CTS | -- | -- | 3 |
| 29 | -- | -- | | -- | -- | 29 |
| 4 | -- | -- | | -- | -- | 4 |
| 30 | -- | -- | | -- | -- | 30 |
| 5 | -- | -- | | -- | -- | 5 |
| 31 | -- | -- | | -- | -- | 31 |
| 6 | -- | -- | | -- | -- | 6 |
| 32 | -- | -- | | -- | -- | 32 |
| 7 | -- | -- | | -- | -- | 7 |
| 33 | -- | -- | | -- | -- | 33 |
| 8 | -- | -- | | -- | -- | 8 |
| 34 | -- | -- | | -- | -- | 34 |
| 9 | -- | -- | | -- | -- | 9 |
| 35 | -- | -- | | -- | -- | 35 |
| 10 | -- | -- | | -- | -- | 10 |
| 36 | -- | -- | | -- | -- | 36 |
| 11 | -- | -- | | -- | -- | 11 |
| 37 | -- | -- | | -- | -- | 37 |
| 12 | -- | -- | | -- | -- | 12 |
| 38 | -- | -- | | -- | -- | 38 |
| 13 | -- | -- | | -- | -- | 13 |
| 39 | -- | -- | | -- | -- | 39 |
| 14 | -- | -- | | -- | -- | 14 |
| 40 | -- | -- | | -- | -- | 40 |
| 15 | -- | -- | | -- | -- | 15 |
| 41 | -- | -- | | -- | -- | 41 |
| 16 | -- | -- | | -- | -- | 16 |
| 42 | -- | -- | | -- | -- | 42 |
| 17 | -- | -- | | -- | -- | 17 |
| 43 | -- | -- | | -- | -- | 43 |
| 18 | -- | -- | | -- | -- | 18 |
| 44 | -- | -- | | -- | -- | 44 |
| 19 | -- | -- | | -- | -- | 19 |
| 45 | -- | -- | | -- | -- | 45 |
| 20 | -- | -- | | -- | -- | 20 |
| 46 | -- | -- | | -- | -- | 46 |
| 21 | -- | -- | | -- | -- | 21 |
| 47 | -- | -- | | -- | -- | 47 |
| 22 | -- | -- | | -- | -- | 22 |
| 48 | -- | -- | | -- | -- | 48 |
| 23 | -- | -- | | -- | -- | 23 |
| 49 | -- | -- | | -- | -- | 49 |
| 24 | -- | -- | | -- | -- | 24 |
| 50 | -- | -- | | -- | -- | 50 |
| 25 | -- | -- | | -- | -- | 25 |

## Multiport Wire List

| Conn. Pin | Port Num. | Signal Name | Wire Color Main/Stripe | Conn. Pin | Port Num. | Signal Name | Wire Color Main/Stripe |
|---|---|---|---|---|---|---|---|
| 1 | 1 | GND | Blue/White | 26 | 1 | GND | White/Blue |
| 2 | 1 | RX | Orange/White | 27 | 1 | TX | White/Orange |
| 3 | 1 | CTS | Green/White | 28 | 1 | RTS | White/Green |
| 4 | 2 | GND | Brown/White | 29 | 2 | GND | White/Brown |
| 5 | 2 | RX | Slate/White | 30 | 2 | TX | White/Slate |
| 6 | 2 | CTS | Blue/Red | 31 | 2 | RTS | Red/Blue |
| 7 | 3 | GND | Orange/Red | 32 | 3 | GND | Red/Orange |
| 8 | 3 | RX | Green/Red | 33 | 3 | TX | Red/Green |
| 9 | 3 | CTS | Brown/Red | 34 | 4 | RTS | Red/Brown |
| 10 | 4 | GND | Slate/Red | 35 | 4 | GND | Red/Slate |
| 11 | 4 | RX | Blue/Black | 36 | 4 | TX | Black/Blue |
| 12 | 4 | CTS | Orange/Black | 37 | 4 | RTS | Black/Orange |
| 13 | 5 | GND | Green/Black | 38 | 5 | GND | Black/Green |
| 14 | 5 | RX | Brown/Black | 39 | 5 | TX | Black/Brown |
| 15 | 5 | CTS | Slate/Black | 40 | 5 | RTS | Black/Slate |
| 16 | 6 | GND | Blue/Yellow | 41 | 6 | GND | Yellow/Blue |
| 17 | 6 | RX | Orange/Yellow | 42 | 6 | TX | Yellow/Orange |
| 18 | 6 | CTS | Green/Yellow | 43 | 6 | RTS | Yellow/Green |
| 19 | 7 | GND | Brown/Yellow | 44 | 7 | GND | Yellow/Brown |
| 20 | 7 | RX | Slate/Yellow | 45 | 7 | TX | Yellow/Slate |
| 21 | 7 | CTS | Blue/Violet | 46 | 7 | RTS | Violet/Blue |
| 22 | 8 | GND | Orange/Violet | 47 | 8 | GND | Violet/Orange |
| 23 | 8 | RX | Green/Violet | 48 | 8 | TX | Violet/Green |
| 24 | 8 | CTS | Brown/Violet | 49 | 8 | RTS | Violet/Brown |
| 25 | — | GND | Slate/Violet | 50 | — | GND | Violet/Slate |

## Octal RS-232 Cable Used with the Multiport Card

| Port Number | RJ2EX Pin # | Color | Signal | DB-25 Pin # |
|---|---|---|---|---|
| 1 | 26 | WHT/BLU | GND | 1 |
| 1 | 1 | BLU/WHT | GND | 7 |
| 1 | 27 | WHT/ORG | TX | 2 |
| 1 | 2 | ORG/WHT | RX | 3 |
| 1 | 28 | WHT/GRN | RTS | 4 |
| 1 | 3 | GRN/WHT | CTS | 5 |
| 2 | 29 | WHT/BLU | GND | 1 |
| 2 | 4 | BLU/WHT | GND | 7 |
| 2 | 30 | WHT/ORG | TX | 2 |
| 2 | 5 | ORG/WHT | RX | 3 |
| 2 | 31 | WHT/GRN | RTS | 4 |
| 2 | 6 | GRN/WHT | CTS | 5 |
| 3 | 32 | WHT/BLU | GND | 1 |
| 3 | 7 | BLU/WHT | GND | 7 |
| 3 | 33 | WHT/ORG | TX | 2 |
| 3 | 8 | ORG/WHT | RX | 3 |
| 3 | 34 | WHT/GRN | RTS | 4 |
| 3 | 9 | GRN/WHT | CTS | 5 |
| 4 | 35 | WHT/BLU | GND | 1 |
| 4 | 10 | BLU/WHT | GND | 7 |
| 4 | 36 | WHT/ORG | TX | 2 |
| 4 | 11 | ORG/WHT | RX | 3 |
| 4 | 37 | WHT/GRN | RTS | 4 |
| 4 | 12 | GRN/WHT | CTS | 5 |
| 5 | 38 | WHT/BLU | GND | 1 |
| 5 | 13 | BLU/WHT | GND | 7 |
| 5 | 39 | WHT/ORG | TX | 2 |
| 5 | 14 | ORG/WHT | RX | 3 |
| 5 | 40 | WHT/GRN | RTS | 4 |
| 5 | 15 | GRN/WHT | CTS | 5 |
| 6 | 41 | WHT/BLU | GND | 1 |
| 6 | 16 | BLU/WHT | GND | 7 |
| 6 | 42 | WHT/ORG | TX | 2 |
| 6 | 17 | ORG/WHT | RX | 3 |
| 6 | 43 | WHT/GRN | RTS | 4 |
| 6 | 18 | GRN/WHT | CTS | 5 |

| Port Number | RJ2EX Pin # | Color | Signal | DB-25 Pin # |
|---|---|---|---|---|
| 7 | 44 | WHT/BLU | GND | 1 |
| 7 | 19 | BLU/WHT | GND | 7 |
| 7 | 45 | WHT/ORG | TX | 2 |
| 7 | 20 | ORG/WHT | RX | 3 |
| 7 | 46 | WHT/GRN | RTS | 4 |
| 7 | 21 | GRN/WHT | CTS | 5 |
| 8 | 47 | WHT/BLU | GND | 1 |
| 8 | 22 | BLU/WHT | GND | 7 |
| 8 | 48 | WHT/ORG | TX | 2 |
| 8 | 23 | ORG/WHT | RX | 3 |
| 8 | 49 | WHT/GRN | RTS | 4 |
| 8 | 24 | GRN/WHT | CTS | 5 |

# Multiport for TNPP and TAP Outdial

## TNPP Overview

TNPP (Telocator Network Paging Protocol) provides a standard method of communicating between paging systems. On the 2000 Series Paging Terminals, it is implemented using the Multiport card running TNPP software.

TNPP was designed to allow the exchange of information between paging terminals, typically this information consists of pages. TNPP is used to link cities together so paging can cover a wider area. It has been used as a concentrator for display pages, where a terminal with a set of local phone lines takes calls and uses TNPP to forward the pages to a remote terminal, thereby avoiding the expense of many FX lines.

TNPP passes *packets* of information between systems. These packets are binary data sent over a serial link. Each system that sends or receives TNPP packets is a *node*. A TNPP network is formed when two or more nodes are connected to each other. Nodes are connected by *links*, a link being the means that data is transferred between the terminals.

Each packet is given a destination code or address. This address is used by a node to determine if the data should be used to cause a locally transmitted page, and also if the packet should be passed along to other nodes in the network.

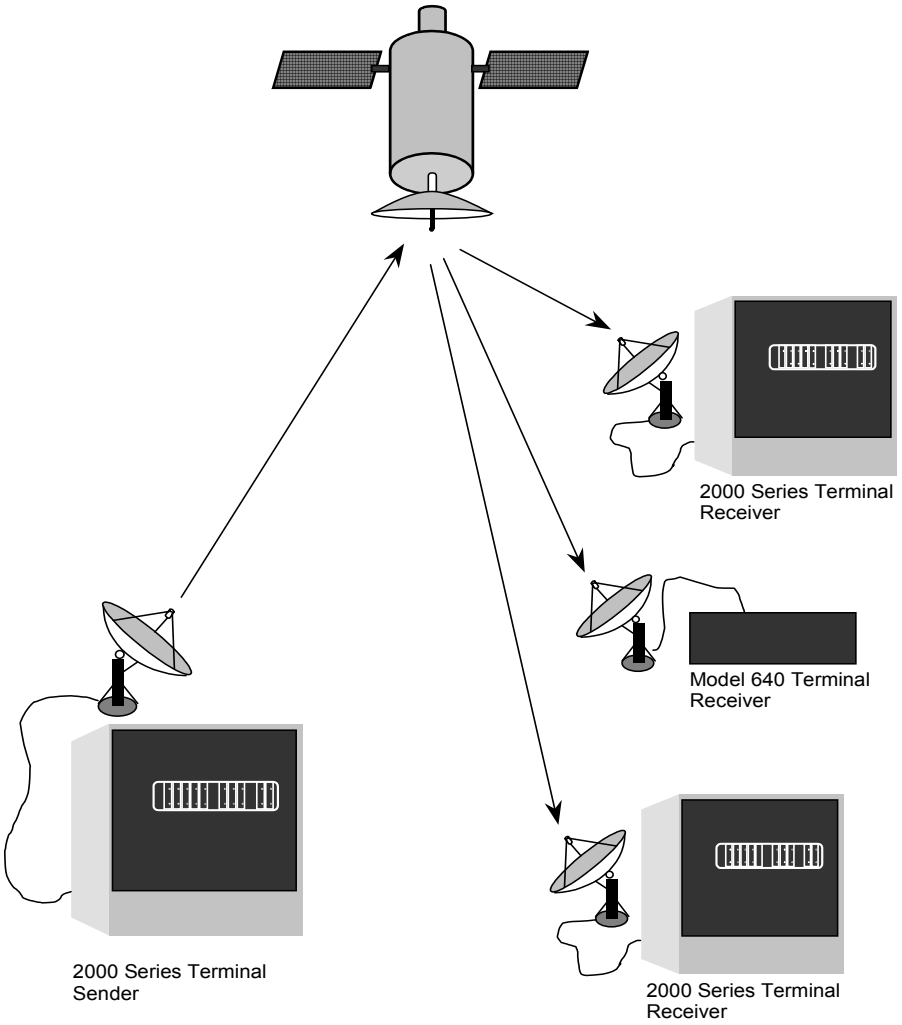
## TNPP Details

A TNPP network may range from just a pair of terminals connected together, to more than 65,000 interconnected terminals. There is a great deal of flexibility in how the terminals may be connected together. However, although there may be many paging terminals connected together within a network, this does not mean that the terminals are all connected with a common circuit. Rather the terminals are “daisy chained” together, with a pair of nodes connected by each link. Pages are passed from terminal to terminal, in a bucket brigade fashion, until they reach their destination.

The number of nodes that may be directly connected to any given terminal is not limited by the TNPP specification, but generally, vendors do not support direct connection with more than eight other nodes.

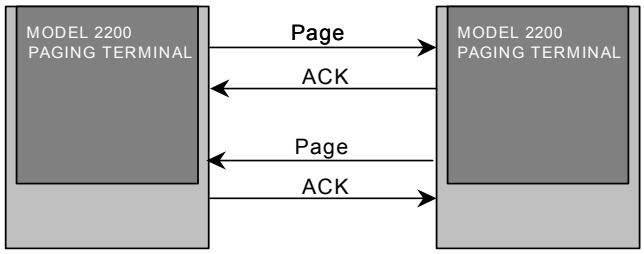
There are two main modes of connecting TNPP nodes together. The *simplex* mode consists of a single transmitter that sends TNPP data to one or more receiving nodes. The simplex mode is limited to one way communications, the transmitting node only sends data, and the receiving nodes only listen. The transmitting node can not be switched to be a receiver. Simplex mode is usually used with a communications satellite link, with the transmitting node being the uplink and each receiving node being supplied with a downlink station in order to pick up the satellite's transmissions. Normally, simplex mode uses the repeated transmission of a packet to insure that a packet is received correctly. The TNPP protocol is designed to discard duplicated packets in order to avoid undesired repetitions of a page.

*Figure 30: Typical Simplex Distribution via Satellite*



The other network configuration is duplex, which allows a bi-directional exchange of data between terminals. A terminal is directly connected to one or more terminals using duplex links, one link for each node to which it connects. One terminal does not need to be directly connected to another terminal node in order to exchange data. What does matter is that there is a chain of nodes that connect the two terminals. In duplex mode, TNPP nodes pass data packets in a bucket brigade fashion. Each node in turn passes the packet along to a node nearer the destination of the packet.

*Figure 31: A Simple Duplex System*




Even when traffic in a system is always in one direction, duplex mode is preferable. In duplex mode, each received packet will cause a response code to be sent back to the node that sent the packet. The response codes are used to indicate in what condition the packet was received.

| | |
|---|---|
| `Acknowledge (ACK)` | the packet was received correctly |
| `Negative Acknowledge (NACK)` | a transmission error was detected |
| `Resend` | temporarily there was not room to hold the packet |
| `Cancel` | there was something unacceptable about the packet |

In addition, during periods of inactivity the nodes will send link test messages to each other. This bi-directional handshaking allows each terminal to monitor the state of the inter-node links, and report any failures.

Each node is assigned its own address, the *node address* or *node ID*, that is unique within the particular network the node is part of and which is often referred to as the primary node ID. This node address may be used to identify what node is the origin of a packet, and to direct a packet to a particular node.

With some implementations of TNPP, including Zetron's, a node may have several *secondary node addresses*. A secondary address may be used simply as an alias for a given node to separate classes of pages for some reason. A secondary address may also be shared by several terminals in what is called *page and pass*. This allows the assigning of a single secondary node address to some wide area function. As an example, a group of terminals might use the address “5555” with all “wide area P5” pages.

## Types of Packets

A TNPP packet may contain *capcode pages*, *subscriber ID pages*, and various types of network related information. Capcode pages include a description of the target pager, such as GSC type II-A pager, channel and zone information, and message class such as beep-only, numeric, or alpha. Because capcode pages fully describe the pager to activate, they do not access the subscriber database. ID pages just send a subscriber ID code, and depend on the receiving terminal to obtain the pager description for its local database. Both capcode pages and ID pages may include a display message, and both carry a function code and a flag indicating whether the page has low or high priority.

The TNPP card connects to the outside world through *ports*. There is one special port, referred to as port zero, which actually is the connection between the Network card and the paging terminal. This port needs no special interface, as it is part of the Multiport card hardware. Besides that, there is some number of external ports, the exact number depending on the particular configuration of your terminal. Each active port is one end of a link.

## Types of Links

A TNPP network port may be considered an RS-232 serial interface. The data is sent in asynchronous format, with eight data bits and no parity. Any method of getting the serial data from one system to another is fine; all that is required is a transmission link that can carry 8-bit digital data. Each active port on the network card is programmed to select its baud rate, network mode, network timing requirements, and other parameters.

With normal TNPP, the link is bi-directional, so when a packet is sent from one node to another the sending node expects a reply code from receiver. Pages may be passed in both directions. There must be a link for each active port on the card; that is, a pair of directly connected nodes must have a dedicated link between them connecting a pair of ports.

The majority of TNPP networks use a UDS 202T modem on a leased 4-wire audio telephone line to communicate between the paging terminals. The 202T modem is widely used in transmitter control links, allowing the same modem type to be kept for spares for both TNPP and transmitter control. The 202T modem is slightly easier to set up than the 212-style modem, but does require the 4-wire telephone lines or equivalent. A microwave link has been used in place of actual telephone lines.

Some systems use 212-type modems instead of 202. This has the advantage that 2-wire telephone lines are used, instead of 4-wire. However, the 212 modem is a bit more sensitive to noise and slightly harder to set up. The 212 modem is not a “Hayes” style modem, but rather a “dumb” modem similar to the original Bell 212 modems.

Other systems use packet radio modems, with pairs of modems programmed to be “permanently” connected to each other. The packet modems provide error detection and data retransmission independent of the error handling of TNPP. While this would seem to allow using TNPP in simplex mode, normally, full duplex TNPP should be used even if the paging traffic is all in one direction. By retaining duplex mode, various problems will be posted in the 2000 Series log files. Poor connection conditions and loss of the link

between two systems are examples of conditions that duplex mode can detect. Packet modem radio can offer cost savings over dedicated lines, but works best with low to moderate traffic volumes. Also, note that systems that send many pages with large display messages over the network may wish to increase the packet modem's packet size, in order to increase throughput.

For further details on TNPP itself, such as a current copy of the protocol standards, look on the web page of the Paging Technical Committee. The URL for this site is currently:

```
www.pagingcarriers.org/ptc.htm
```

# TNPP Limitations and Specifications

## Limitations of TNPP

Tone-only, numeric, and alphanumeric display paging can be done; however, voice paging is not supported. This is a limitation of TNPP itself, not our system. You may configure the 2000 Series so that a call to a voice pager will have the voice message transmitted at the terminal of origin, and cause an alert page sent over the network. Combining this with the Insurance mode of PageSaver allows a subscriber with a voice pager to take advantage of wide area network paging.

## Our Current TNPP Limitations

You must have a continuous link between the systems. There is no provision for any kind of dial-up line at this time.

TNPP provides for either capcode paging, or subscriber ID paging. Capcode paging is supported by most systems; subscriber paging is not as widely supported. Zetron supports both capcode and ID paging.

## Limitations of Multi-node TNPP

There are three classes of node addresses as recognized by Zetron's Multi-node TNPP. The first class is the primary node address of the terminal. As this address should be unique within the network any page that has a destination address matching that of the terminal's primary address is accepted and routed into the paging terminal. Such packets are never routed on to other terminals.

The second type of node address is the distinct secondary address, where each address is explicitly programmed into the terminal. Currently up to 32 incoming addresses may be specified. These addresses may be programmed as pass through addresses that route packets on to other nodes, or as secondary node IDs that cause pages to be transmitted by the terminal. Any mixture of address types may be selected.

The third class of addresses is any node address not selected in the other two classes. These can be considered as “unknown” node addresses. What action to take when handling an unknown address is configured on a per-port basis. The choice of action include rejecting the packet, by sending a Cancel reply, accept the packet but then ignore it, and to accept the packet and route it to one or more ports.

To route to more than one port, your Multiport card needs sufficient serial ports, software options, and the associated link connection to each additional TNPP network node. The Multiport card provides an RS-232 serial interface per port; the link connection must interface with this. Please note that the amount of network traffic in your application may place restrictions on the type of link that you use.

## Items Supplied for this Configuration

Instead of the regular Multiport software, the items listed in Table 15 are supplied for TNPP Multiport operation.

*Table 17: Items Supplied in TNPP Multiport Option*

| Qty | Part # | Description |
|---|---|---|
| 1 | -B90 | ZbaseW Software Update to add Networking options, if needed |
| 1 | -Bl6 | Network USA (one-way) software (usually transferred via modem to your paging terminal) |

When running ZPAGE version 310 or later the Multiport card can support both Network USA and bi-directional TNPP at the same time.

## Port Configuration

When used for Multi-Node TNPP, you need enough serial ports on the Multiport card (950-9346) for the number of physical TNPP nodes/links you will be connecting.

When used for Single-Node TNPP, the Multiport card hardware is only used in its two-port configuration. Only a single serial port is actually used. (There is present a second physical serial port, which is used only for production testing).

If Satellite mode, the -B16 option, is the only active option then the Multiport hardware is only used in its two-port mode. However the card is not restricted to just a single software or two hardware port mode, full bi-directional TNPP may be added by purchasing the needed number of -B17 options.

When used for networking the Multiport card is dedicated to supporting TNPP. You can not use the other serial ports that are potentially available on the card's hardware for any other functions, such as alpha input.

## Using TNPP with ZbaseW v310 and Zpage v310

### Checking ZbaseW Configuration

If you are upgrading to receive Satellite TNPP paging, the 950-9347 option, and do not have a duplex option (950-9346) then there are no changes or updates to ZbaseW and you do not need to check your ZbaseW configuration. If you are upgrading to include full TNPP Networking, first do any ZbaseW updates shipped as part of your upgrade.

Then verify you now have Networking available. Start up ZbaseW, choose Edit Subscribers (or View Subscribers), go to an existing record, and move the cursor to the Transmitter(s) field. If the HELP window shows an entry for network, such as "N = Network Destination", it verifies your ZbaseW now has the Networking option. If not, call us.

### Outgoing Pages - Multi-node Systems

Outgoing Network pages are selected by typing an "N" in the Transmitter(s) entry, and then entering the desired network destination name in the Node ID field. If this is to be an ID page then the ID field should be filled out as well. For capcode pages, the pager information must be fully filled in, just as for local RF pages.

For each outgoing address, the information we need is:

- Destination name and the corresponding TNPP address (tell us whether it is stated in decimal or hexadecimal).
- Whether the page is going out locally, is to be routed elsewhere along the network, or both.
- If going out locally, put to what Channel(s) & Zone(s); if going back out to the network, put to which node and what address.
- Which local (ZbaseW) priority should cause a page to be sent as a high priority network page. TNPP pages have two priority levels, ordinary and high.

### Incoming Pages - Multi-Node Systems

To tell the system where to put out pages that it gets from the network. You need to tell us what you want to happen for each incoming address. (There is nothing for you to do in ZbaseW, all configuration is done on the paging terminal).

For each incoming address, the information we need is:

- Incoming TNPP address (tell us whether it is in decimal or hex).
- Whether the page is going out locally, is to be routed elsewhere along the network, or both.
- If the pages are to be transmitted locally, are they capcode or ID pages. If they are capcode pages then you will need to tell us if the TNPP channel and zone values are of importance, and if so how are they to be used locally. The TNPP channel and zone may be used as extensions of the TNPP node ID, a particular TNPP channel and zone may be mapped to a local RF channel and zone.

- If going out locally, put to what Channel(s) & Zone(s); if going back out to the network, put to which node and what address.
- What priority to assign to these incoming pages (like ZbaseW priority). Please note that TNPP pages have two priority levels, ordinary and high. You may choose which ZbaseW style priorities to assign to the two network priorities.

Using this information, we will set up the configuration for the terminal in the "network.cus" file.

## Network CUS Parameter File

`network.cus` is a configuration file on the paging terminal. It is not needed unless you have one of the TNPP Network options. It is used to relate base network destination names to actual network addresses, and to select how incoming pages will be transmitted locally.

One type of entry in the `network.cus` file is the Outbound entry, which is used to map from a TNPP destination name to actual network addresses. It is also used to determine how to treat the priority level of outgoing pages. This entry may also be used to set the TNPP channel and zone of capcode pages, and to attach local RF channel and zone values to network destination names.

Another type of entry is the Inbound record, which is used to determine what to do with incoming network pages that the network card passes along to the terminal. It is used to select ranges of node addresses to respond to. TNPP channel and zone values, on capcode pages, or subscriber ID values, on ID pages, may also serve as selection criteria. Finally the Inbound record is used to describe what RF channel and zone information to use with pages that match its selection values.

Refer to the "System Configuration Files" section later in this manual for general information on configuration files.

## Configuration - TNPP Addresses

In addition to the information shown for the basic Multiport card, the following is needed:

- The incoming TNPP address(es) - our ID(s) that the other machine(s) on the network will know us by.

  When the other system sends a page, part of the information packet is an address. Since there can be multiple paging terminals on a network, we need to know which address means us (or which addresses mean us if Multi-Node). Each address is set in the oparam.cds file. Therefore, you need to find out the address(es) that the other system will be sending to us, and tell us.
- The outgoing TNPP address(es) - the ID(s) of another machine or machines on the network where we will send outgoing network pages.

  This depends on what the other system's address is (or system addresses are if

Multi-Node), so that they recognize that the pages we send are intended for them. Find out this address or addresses, and tell us.

For all TNPP address values, please find out if they are being stated in hexadecimal (base 16) or decimal (base 10).

## Software Configuration

Following are the differences in configuration between regular Multiport and TNPP configurations:

There is a different image file, so CONFIG.CDS looks like this (example):

```
13 8 8tnpp8c3.img; card 13, multiport TNPP rev. 8c3
```

And OPARAM.CDS would look like the following example.

```
;
; Network 14:  Physical Node ID = 0908h
;
;   Set the Port attributes
;
;               full  1200  accpt  ukn dst
;               dplx  baud   any    route
0E 01   09   05  03    01   00 10   80 00   00  00  ;
0E 02   09   05  03    01   00 10   80 00   00  00  ;
;
;  Routing information for known node IDs
;                  Node ID     Route  Accept
;Card  Cnt   Op    to route      to    from  Inertia
0E 00   0A   04   00 00 08 01   00 07  00 07   09 ; CAP CODE I/O
0E 00   0A   04   00 00 08 07   00 05  00 06   02 ; From rest of Net, to us
0E 00   0A   04   00 00 08 00   00 02  00 01   02 ; From us
;
;   Incoming pages addressed to the physical node ID are always
;   routed into the terminal.
;
;   The next line should always be the last in the TNPP card settings
;
; TNPP params:      Physical Node ID
0E 00   0A   17     09 08              00 00 00 00   10 00 04
```

## Limitations of Single-node TNPP (Older Systems)

If you are running a version of ZPAGE that is older than version 310 then there are several restrictions to TNPP on your system. TNPP prior to V310 ZPAGE could only do capcode paging; ID paging was not supported.

You are restricted to directly connecting to just one node. Only a single incoming address is accepted. Likewise, only a single outgoing address can be specified. In other words, when sending a page FROM other equipment on the network TO the Zetron, the other equipment must send to one and only one particular address.

When sending a page FROM the Zetron TO other equipment on the network, only a single destination address can be specified.

In addition, the older versions of ZPAGE and TNPP do not serve as a node that can pass a page along to another terminal if it is not intended for us. In other words, we must be at the "end" of the network connections, not somewhere in the middle.

TNPP provides for channel/zone information to be provided along with a page. Right now, we ignore this information on incoming pages, and set it to a particular default value for outgoing pages.

These limitations in the single-node software can be overcome by upgrading to the multi-node TNPP software discussed above - contact Zetron.

## Format of TNPP Related Log File Postings

This section covers the format of a TNPP posting in Version 310 log files.

The source and destination units for network related pages is "p,iiiiN", this corresponds to the "ccuL" of trunks and "c|zzS"of station cards. The "p" is the port number relating to the posting, for outgoing pages this will be a zero as the interface between the network card and the main terminal is referred to as port zero. For inbound pages and network status reporting the port number is the port number or serial channel on the card. The "iiii" following the comma is the node ID (node address), in hexadecimal notation. The "N" stands for NIU, or Network Interface Unit.

When a network address is in the "source" field, it is the address of the node that originally sent the page. A network address in the "destination" field then it is the address this terminal is sending the page to, similar to the transmitter channel and zone values for a RF page.

Inbound capcode pages and most network status reports do not have a subscriber ID. Rather than leading off with a subscriber ID, they start with "NETiiii", where "iiii" is the destination node ID.

```
NET0002 port link up     12:09:40p  1  1,0000N
```

This terminal sent a link test to the other node, connected to port one, and received the proper response. This terminal can now send pages to the other node.

```
NET0002 port Reset sent  12:09:41p  1  1,0000N
```

This terminal sent a link reset packet to the other node, connected to port one. This is done when first connecting to the other nodes, after a reboot.

```
NET0002 port Reset seen  12:09:43p  1  2,0105N
```

This terminal received a link reset packet from the other node, connected to port two.

```
?     0009 page bad dest    12:09:57p  1      7AL  1,0111N
```

The page was to be sent to node "0111", and the terminal has not been programmed to know anything about node "0111"

```
?  NET0002 page no dest     03:49:15p  1  1,0101N        -
```

A packet addressed to node "0101" was received. The Network card was programmed to route "0101" to Central, but Central has not been programmed as how to send such pages - the RF paging information is missing. Check the network.cus file.

```
?     0098 page no dest     10:03:25a 1      8AL BLORKSNGV
```

A locally originated page with "Network" destination where the entered node name was not in the network.cus file. The node name is posted, followed by a "V", which stands for a "Virtual destination" type.

```
-  NET0002 port Link Down   03:48:48p  1  2,0105N
```

The link to the node connected to port two has gone down. No pages will be sent to that port.

```
.  0000 page dest down   03:47:46p  1    7AL  2,0105N P0  00000000 D  3 *0*
```

A network outbound page should be routed out port two, but that port currently is down.

```
.  0000 page CAN reply   03:47:49p  1    7AL  2,0105N P0  00000000 D  3 *0*
```

A network outbound page was sent out port two, and a <CAN> was received as the reply to it. This usually means the other node, connected to port two, does not know about the destination node ID, or did not like something about the page.

```
.  0000 page NAK fail    03:47:55p  1    7AL  2,0105N P0  00000000 D  3 *0*
```

A network outbound page was sent out port two, and it received a <NAK> to each attempt to send it, until the retry limit was reached. This usually means the link is a very noisy, the link is not properly set up, or the other node, connected to port two, did not like something about the page.

```
.  0000 page RS fail     03:53:56p  1    7AL  2,0105N P0  00000000 D  3 *0*
```

A network outbound page was sent out port two, and it received a <RS> to each attempt to send it, until the resend limit was reached. This usually means the link is too busy (too much traffic, too many very long messages), the other node is too busy, or the page is too long for the other node to handle.

```
.  0000 page timed out   03:55:36p  1    7AL  2,0105N P0  00000000 D  3 *0*
```

A network outbound page was sent out port two, and the port did not receive a response to the packet within the timeout interval. When using RF packet modems this often indicates troubles with the RF transmissions such as a weak signal or an interfering transmission. The packet modems are retrying the transmission, and may succeed in sending the packet, but the round trip time is too long.

```
.  0000 packet timed out 03:56:11p  1      7AL  2,0105N
```

While port two was receiving an inbound packet, there was too long of a gap between characters. In effect, the packet being received was chopped off short. Often this means that the link has broken or interfered with, a noise burst on a RF or telephoned link could cause this. The packet's sender should retry the transmission, however the constant appearance of this log message indicates possible problems with the inter-node link.

```
-  NET0002 packet too far   03:56:43p  1      7AL  2,0105N
```

Port two received an inbound packet that had an inertia value of one, and the routing for the destination indicated that the packet was to be routed out another serial port. This is caused by an error in network programming. One possibility is that this terminal should not be routing the destination, 0105 in the example, received from this port, port two in the example, back out another port. Another other possibility is that the node originating the page, which is 0002 in the example, does not have the inertia for the destination set high enough.

```
-  NET0002 packet too big   03:56:50p  1      7AL  2,0105N
```

Port two received an inbound packet that appeared to be too long, containing more than 1024 bytes. Generally, this is caused by noise or other problems on the link, or by excessive traffic on a simplex or blind link.

```
-  NET0002 packet bad CRC   03:57:12p  1      7AL  2,0105N
```

Port two received an inbound packet that failed the CRC error check. Generally, this is caused by interference on the link. The constant appearance of this log message indicates possible problems with the inter-node link, such as noise or low signal levels.

```
-  NET0002 packet SUB-ETB   03:57:33p  1      7AL  2,0105N
```

Port two received an inbound packet that possibly had a non-standard control sequence. The inter-block marker, the <ETB> byte, appears to have arrived as an escaped character pair, <SUB>. Some TNPP implementations do this, and Zetron's TNPP can be programmed to handle the condition. The other possibility is that the <ETB> byte was actually part of a page's message, however this is not very likely.

```
.  NET0002 port unk node    03:59:02p  1      7AL  2,4444N
```

A network inbound packet was received at port 2, and the network card had not been programmed to handle the destination node ID (“4444” in the example).

```
-  0099 test pg RS fail  09:59:15a 2        C   TAP03D ID [     16]
```

Sample of a failed ID page to a TAP outdial destination.

## TNPP Link Tips - UDS 202T and Leased Line

When first connecting the modems, you will find it best to have an individual at each site and in communication with each other. Verify that the modems are properly connected to the telephone lines.

Note that in leased line, or 4-wire, mode the modem connection to the telephone line is very similar to an RS-232 type connect in that there is a transmit pair of lines and a receive pair. You must make sure that one modem has its transmit pair connected to the other modem's receive pair.

First power the modems on and run their self-test by moving the front panel rotary switch to the ST position. Verify that the TM LED is steadily on. If this LED is flashing, then the modem is failing its internal tests.

Place both modems into the DATA mode by turning the switch to the DATA position. Within a second, both modems should carrier lock, shown by the lighting of their CD LEDs. Once this has been verified, confirm that carrier loss can be detected. Do this by switching one of the modems to the TALK mode - the other modem's CD LED should go dark. Placing the modem back in DATA mode will reestablish CD at the other modem.

If switching one modem to TALK mode does not extinguish the CD LED on the other modem, then either the second modem, in DATA mode, has its carrier detect sensitivity set too high, or the second modem is “hearing” itself for some other reason. This could be excessive cross talk on the telephone lines or a wiring problem in connecting the modems to the 4-wire line.

Next, place one of the modems in the Test Pattern mode by moving its switch to the TTP position. The other modem should have its MR/RI, TR, and CD LED steady on, and its RD LED flashing or flickering mostly on. Place the first modem back in DATA mode and repeat the test for the second modem by placing it in the TTP mode. See the 202T manual for more information on the Test Pattern mode.

If the above tests were successful, it should be possible to establish the TNPP link. Connect the modems to the TNPP serial ports. Check that both modems are in DATA mode and that their CD LEDs are on.

If there are problems in establishing the TNPP link, some simple fault isolation may be performed. This can help in pointing out if the problem lies in the TNPP card and its serial cable connection to the modem, or in the modems or telephone line.

If a modem is placed in the AL (analog loopback) mode, then the TNPP card connected to the modem is “talking to itself”. Within 20 seconds, it should indicate a link-up state by fully lighting the CHAN LED for the modem connection. It is not likely that TNPP packets will properly transmit, as the terminal is most likely not programmed to “hear” packets that it transmits. However, the link should remain up, indicating that the TNPP card, the serial cable connections, and most of the modem are functional. The other modem should have indicated loss of carrier by turning off its CD LED.

If one modem is in DATA mode and the other modem is switched to DL (digital loopback) mode, then the telephone line and both modems can be checked. When in this state, the modem in DATA mode should have its CD LED on. The TNPP card connected to the modem in DATA mode should enter the link-up state within 20 seconds. If it does so, this shows that the TNPP card, both modems, and the telephone line are functioning.

# TAP Outdial

TAP Outdial uses a Multiport serial card with an external modem to dial other paging terminals to deliver pages using TAP (Telocater Alphanumeric Protocol).

When a caller enters a subscriber ID that is set up as TAP Outdial in the paging terminal, the terminal takes the message, then turns around and dials out (on a regular end-to-end phone line) to another paging service and delivers the message via TAP. For more on general and operational details, refer to the “Outdial TAP Networking” section of 2000 Series Paging Terminals Operating and Programming Manual (Part No. 025-9034-001).

TAP outdial is separate from TNPP. A Multiport card can be used for one or the other, but not both on the same card.

The modem used should be a Hayes-compatible external modem. This is the same type of external modem that is typically used with personal computers. For most applications, a 1200 baud (212-type) modem (which does 300 baud as well) is sufficient.

Higher-speed modems generally are not needed or beneficial for this application, since few systems support TAP input at higher rates. However, higher-speed modems can be used as long as they can do the lower baud rates; but they tend to have more settings and be more complicated to set up than a plain 1200 baud modem. Strictly speaking, the modem does not have to be Hayes-compatible. Any modem that is Bell 103 and/or 212 compatible, and can originate calls, should work.

For the pinouts of the Multiport card, punchdown block, and cables, refer to the previous section on the Multiport Serial Card in this manual.

It is a good idea to have the modem's DTR input line driven by the TAP Outdial (Multiport) card. In other words, the output line labeled “RTS” on the diagrams should be connected to the modem's DTR input (usually pin 20). Also, it is nice if the modem's carrier detect (CD) output line drives the TAP card's CTS input line.

Outdial TAP is restricted to ID paging. This is a limitation of TAP itself. Refer to Appendix A if you are interested in the details of the TAP protocol.

## Modem Related Information

The signal line we normally call RTS (pin 4 on the DB25) should be connected to the DTR pin (# 20) of the DB-25.

The reason to drive the DTR line is that the “Hayes escape sequence” of <pause>+++<pause> may not always get a modem into command mode. Driving DTR inactive has a better chance of getting a modem into command mode; however, as a side effect, it often causes the modem to hang up the telephone line.

The modem being used should be configured to respond to DTR. On older modems, this is usually set by a DIP switch. Newer modems use “AT” commands - the factory setting is

often “&D0” to cause the modem to ignore the DTR line. You want to use “&D2” to enable the DTR. This causes the modem to hang up and enter the command state.

Note that the command mode escape sequence can be disabled by setting S2=128, or any value between 128 and 255. For safety the escape sequence should not be disabled, putting “S2=43” in an initialization string will enable the standard escape sequence.

If possible, the modem should be configured to not auto-answer incoming calls. For most Hayes compatible modems this can be done by including “S0=0” in one of the modem initialization strings. Some modems may have a switch or front panel programming option to disable auto-answer, these controls may override the “S0=” setting.

Many newer modems support various forms of data compression and error detection. These modes of operation can interfere with TAP, in particular with the log-in stage, and so should be disabled. Exactly how this is done will vary from modem to modem. On some modems “&Q0” within an AT string will disable all error control, special buffering, and data compression. When checking for such features and commands in the modem's documentation, you should look for the keywords “MNP”, “V.42”, and “compression”. Again, a few modems that have front panel programming may have settings that override the “AT” based commands.

## OPARAM CDS Settings

The outdial TAP card has two general classes of option parameters. One set applies to the programming of the modem, or other interface device, itself. These parameters relate to the control of the modem itself.

The second set of parameters is used to determine the behavior for a given TAP destination. There is one set of these parameters per active destination. Some of the parameters must be filled in for each destination, although many parameters will work correctly with the default values.

Refer to *TAP Outdial OPARAM Codes* on page 251, for details of `oparam.cds` programming.

## NETWORK.CUS Settings

Besides the `oparam.cds` settings there must be a way to map from the subscribers' network destinations, set in ZbaseW, to the outdial TAP destination numbers. This is done on the paging terminal, using entries in the `network.cus` file.

For each unique network destination used in ZbaseW, there should be an “`Outbound`” entry in the `network.cus` file. In order to send a page to the outdial TAP card an “`Outbound`” entry should include an outdial TAP destination specification in its list of actual destinations. To specify a TAP destination use a string of the form “`TAP##D`”, where “`##`” is the actual outdial TAP destination number. Currently valid TAP destination numbers are between 0 and 15 (decimal). The number may be one or two digits long; a leading zero will be accepted but is not required.

The following lines are three examples of `network.cus` settings for outdial TAP destinations. The first will just send pages to TAP destination one. The second will send pages to TAP destination number five and to be transmitted locally on channel one, zone three. In the third example, each page will be sent to several TAP destinations. For this last example to work the subscriber must have the same database ID on all of the target paging systems.

```
Outbound "SeaPage"      3    TAP1D  ; 1 TAP outdial destination
Outbound "FRED'S"       3    TAP05D  1|3S  ; 1 TAP outdial & local
Outbound "AllOver"      3    1|0S TAP0D  TAP1D  TAP2D ; local & 3 TAPs
```

## TAP Outdial Processing

During the process of a call, the following process takes place. The string names, oparam numbers, and default values are listed in the *System Configuration Files* on page 217. Refer to the TAP Outdial subsection for details on the #Fx/#Ex strings. If a string is empty, then the send and wait for response operations are skipped. If an expected response string is empty, then there is no wait for response. The process proceeds to the next sending operation.

## TAP Outdial Status

During operation of the outdial TAP card the LEDs on the card may be used to monitor the card's state. The **SELECT** LED indicates that the paging terminal knows about and is monitoring the outdial TAP card. The **TEST 3** LED is lit whenever the card and paging terminal actively communicate. The **TEST 2** LED flashes briefly when a page is batched to the card.

The **CHANNEL 1** LED flashes when there are pages batched on the card, waiting to be sent. These pages may be waiting for their batching limits to be reached, or they may be in the process of being sent to another terminal.

The **CHANNEL 2** LED is lit solid on whenever the outdial TAP card has a “hot” destination, and is in the process of dialing the destination or transferring pages. Thus **COMM 2** indicates that at least one destination has an active batch of pages for it.

# Theory of Operation

## Overview

This section presents the theory of operation for the paging terminal. Circuit descriptions are provided for each of the cards. This section also contains a complete set of charts that describe the sequence of events that takes place when call are processed by the paging terminal (call processing charts). A complete set to timing diagrams for the telco side of the system and the radio side of the system is contained at the back of the section.

The Series 2000 Paging Terminals are multiple microprocessor systems whose software intensive architecture greatly reduces the cost of dial-access paging compared to older technologies. A central processing unit (CPU 702-9176) controls all internal operations in accordance with a paging control program stored on hard disk. The CPU provides system power down detection, system reset, software “watchdog”, system clock calendar, timing for the PCM highway, progress tones, temperature, and system status lights. A 1200/9600 baud Modem Card (802-0041) connects to the office computer for database management and remote maintenance. With the local connection, the CPU also provides an RS-232 interface for direct connection of the office computer without requiring a dial-up telephone line for subscriber management. The Hard disk Card (950-9618 or 950-0258) contains disk storage to hold the paging software, trunk/station/voice card firmware, subscriber database, system log files, and voice files to operate the Series 2000 terminals.

## System Startup

After an input power cycle or a remote ZlinkW “reboot” command, the CPU card resets all cards in the system. Each card in the system blinks its lights for a few seconds to indicate it is alive. The CPU card then performs a test on the system memory (about 30 seconds) during which time most of the system lights are static.

The CPU then loads the Disk Operating Software (DOS) from the boot portion of the hard disk. DOS in turn accesses the file named “`autoexec.bat`” which does some

preliminary set-up work and then runs the file "`custboot.bat`", which sets up the Series 2000 for paging by loading the paging software from the hard disk and launching its execution. The CPU first flashes the **TMP**, **COM B**, **COM A**, and **T4** through **T1** LEDs, and then sets the **T1** through **T4** LEDs to reflect the positions of switches **C1** through **C4**.

The paging software then initializes each peripheral (Trunk, Station, Voice, Modem, etc.) card and loads its operating firmware from hard disk. Specific firmware filenames and operating parameters (valid telephone blocks, station IDs, etc.) are tailored for each card slot by the configuration file. Since the firmware is stored on hard disk and not in Read-Only-Memory, Zetron can update any installed terminal with just a telephone call.

As firmware is loaded into an interface card, the card's **SELECT** light comes on. Station cards (702-9441) also blink their **TEST 1** light; Trunk cards (702-9117) blink their **TEST 3** light. The paging software causes the **SELECT** and **TEST** light to behave this way until firmware loading is complete (8 to 15 seconds) for that card. Once all firmware is loaded, and the CPU has tested the cards for proper operation, the Series 2000 Terminal goes "on-line" for paging. The CPU continually polls the microprocessors on each interface cards for any required service. The distributed multiple microprocessors of the 2000 Series dedicates intelligence right where it is needed. Each processor guarantees instant service to a telephone caller or radio. Multiple processors also mean that as the system is expanded with more cards, more computer power is also added to keep throughput high and clients happy.

# System Operation

## CPU Indicators

During normal operations, many of the LEDs on the CPU indicate various aspects of system operations. The **DMA** LED indicates DMA transfers, these include data file reads and writes as well as voice file transfers. The **EMS** LED indicates accesses to the EMS memory, used by all systems. The **MDM** LED lights when ZlinkW is active on the Modem port, as well as the **COM A** LED for the local connection port (if installed). The LED will be on with short periods of darkness when the link is transferring data. When the link is connected but idle, it will be mostly dark with a short flash on every two to four seconds. The **TMP** LED will light if the terminal is operating outside of its temperature range. The **RST** LED will be on whenever a CPU reset is occurring. The **FLT** LED is on whenever a fault condition has been detected, and after a reset but before the system has booted.

## Idle

After all cards are initialized and operating parameters loaded, the system does its housekeeping on the hard disk and goes into the normal idle state. It scans each interface card looking for incoming calls from the Trunk cards and outgoing page requests from the

Station cards. The **SELECT** light and the **TEST 3** lights indicate transactions between the paging system and the interface cards. It is normal to see the Station cards blink at a faster rate than the Trunk cards in order to give outgoing paging high priority. It is also normal that the **SELECT** light of the Station card farthest to the right in the card cage appears on most of the time. In fact, it is blinking at the same rate but for a longer period giving the illusion of being on solid.

### Call Processing

The dual (702-9117) Trunk card **TEST 1** light indicates decoding of dial pulse, DTMF, or voice for the first unit or phone line while the **TEST 2** light does the same for the second.

The Station card test lights do not generally light. See *Trunk Cards and Connections* on page 71, *Radio System* on page 97, and *Troubleshooting and Repair Procedures* on page 179 for more information on lights.

## CPU Card (702-9176)

Advanced large-scale integrated circuits (LSI) pack an entire computer, including 1MB to 4MB or more of memory. Paging software loaded from hard disk at power-on operates in the RAM memory on this card and acts as traffic manager and diagnostic maintenance controller for the microprocessors on all of the telephone and radio interface cards.

This card also provides the central timing logic for the PCM digitized audio highway that all of the circuit cards use for passing audio among them. Prompting tones are generated on dedicated PCM channel slots for 1 kHz beep, out of service whoop, telco dial tone, telco ringing sound, and telco busy sound.

Power-on reset timing and a watchdog circuit help recover from any software faults or high energy noise interference that might stop system operation. Front panel indicators are addressable by the CPU to show operating system status.

The CPU provides PCM synchronization pulses, master reset signal, watchdog timer, non-volatile RAM, a temperature sensor and A/D converter, and a real-time clock.

The watchdog and reset circuit is comprised of U25, and U64. U64 provides the initial 300 millisecond power-up reset pulse. U25 is the watchdog timer. The system must write to it once a second to keep it from initializing a reset pulse. The watchdog is disabled from resetting the system for about four minutes from power up so to let the system boot all of the way up. The watchdog can be disabled by placing switch 7, labeled “**WAT**”, in the “A” position.

The PCM highway is comprised of three signals: data, clock, and sync. Data is a time-multiplexed serial signal and can be encoded or decoded by almost any Zetron card. The clock and sync signal is produced on the Master Card.

The clock signal is a 1.544 MHz square wave that synchronizes the serial data. Eight clock pulses constitute a “slot”. Audio is converted into 8-bit words and presented in one slot. Twenty-four slots constitute a “frame”. The sync pulse marks the beginning of a frame and is one clock cycle of duration with a period of about 125 microseconds (8 kHz sampling rate). Each slot can be thought of a channel carrying unidirectional audio information (just like a radio channel).

The CPU card provides six slots, or channels, of tones available to any card on the highway. This is the source of all of the telephone prompts and some of the station card prompts.

The non-volatile RAM and real time clock function is provided by a special socket in which U50 resides. The socket eliminates the need for a separate real-time clock board on the IBM bus.

An RS-232C compatible input/output port provides direct connection between the office computer and the Series 2000 terminal. This port operates at 1200/9600 baud.

The connector to the card is brought out on a cable ending in a female DB-25. The pinout for this connector is shown in Table 18 (refer to the Local Connect portion of the troubleshooting section for cabling details):

*Table 18: RS-232 Connector Pinout*

| Pin # | Signal Name |
|---|---|
| 2 | Transmit Data |
| 3 | Receive Data |
| 4 | Request to Send |
| 5 | Clear to Send |
| 6 | Data Set Ready |
| 7 | Ground |
| 8 | Carrier Detect |
| 20 | Data Terminal Ready |

The approximate cable length, assuming good quality shielded twisted pair cabling, should not exceed 60 feet.

There are a series of switches at the top of the CPU card. These are used to set various hardware and software options. Some of the software options also apply to the older Master card system.

# Modem Card (802-0041)

A 9600 baud modem on this circuit card provides the dial-up remote port for Zetron maintenance of the 2000 Series system. Two RJ-11C connectors on edge of the card provide convenient connection points for the input telephone line and a bridged telephone. Software on the CPU card constantly polls the modem card for any incoming telephone call and connects the Zetron maintenance staff computer to the paging terminal diagnostic software system. The communications protocol used on this port is Zetron proprietary and therefore inaccessible to any “normal”, off-the-shelf, communications software packages that may attempt to invade the system. The pinout of the modular connector labeled “to Line” is shown in Table 17.

*Table 19: Modem Card (802-0041) “Line” Pinout*

| Pin # | Signal Name | Purpose |
|---|---|---|
| 1 | | not used |
| 2 | A | Key system busy circuit lamp for RJ-12 |
| 3 | Ring | Telco “Ring” wire |
| 4 | Tip | Telco “Tip” wire |
| 5 | A1 | Key system busy circuit lamp for RJ-12 |
| 6 | | not used |

# SCSI

SCSI stands for “Small Computer System Interface”; it is commonly pronounced as “skuzzy”. It is a high speed, industry standard interface used to access the Series 2000 disk drive for storage.

Current Model 2100 systems use only one disk drive regardless of size (unless voice mirroring is used). For all Model 2100 systems (and Model 2200 systems with less than six hours of voice storage), there is a single hard disk system on a card, in slot 1. We make this disk system by mounting a SCSI host adapter, a 3.5" SCSI drive, power, and SCSI cables on a metal frame. This assembly is sometimes referred to as the “Zetron hard card.”

For larger voice storage systems in Model 2200, instead of a hard disk system on a card, the SCSI controller on the Pentium CPU card is used. Thus, there is still a single disk drive in the system, but the physical mounting is different due to the larger, heavier drives.

Zetron preformats any hard disks or spares sent with your system. Most of the disk is partitioned for our proprietary voice storage system for high-speed access to voice files. The boot part of the disk is a DOS partition, with the programs and configuration files necessary for your particular configuration. DO NOT attempt to format the drive yourself.

There are a number of jumpers on the SCSI host adapter. These are pre-set at the factory and should never be changed in the field unless we have given you explicit instructions to do so.

## 2200EX

The 2200EX chassis is under control of the 2200 main chassis through its interconnection via the 702-9204 Expand boards. The Expand boards use high-speed bus transceivers to interface with each other over a shielded cable. This cable is terminated with a characteristic impedance that matchs the impedance of the cable. This is done to reduce signal reflections. The Expand cards can be configured as a Master (2200) or Slave (2200EX) unit. The direction of each card is determined by the installation of DIP shunts, which connect the receive outputs of the transceivers, where appropriate.

All applicable PC Bus signals are transmitted from the main chassis and received at the expansion chassis. These signals include all address lines and the appropriate control lines. The data bus is bi-directional and can be thought of as an extended wired-or. PC Bus write data is provided to both the main and slave chassis.

The slave chassis is enabled to drive the data lines back to the main chassis during read operations only. These lines will not be driven if the slave chassis data bus is inactive. If the read data is coming from the main chassis, it will drive the main bus directly. The expansion card data drivers will not interfere since they are open collector.

The PCM data is handled similarly, although it is complicated by the fact that there is no control signal, such as with the PC read strobes MEMR and IOR, to enable the appropriate drivers. This lack is overcome by an interlock signal. When one side of the PCM bus starts to drive low, the transmitted signal blocks the other side from driving back. When the signal goes inactive, a delayed counterpart of the transmitted signal is used to block backward transmission for an interval sufficient to prevent unwanted oscillation.

## Dual Trunk Card (702-9117) Rev D and Later

The Dual Trunk Card interfaces two sets of telephone lines to the paging terminal. Telephone lines are brought to the Dual Trunk Card through the Z-bus. Which lines are brought to the Dual Trunk Card is dependent on the slot the Dual Trunk Card resides in. Each slot has access to two separate unique telephone lines.

The Dual Trunk Card can interface different types of lines. Dual four position matrix plugs determine the type of interface provided for each trunk. The two trunks need not be set to the same line type. In the DID position, the interface is for C.O. Selector level, local or PABX loop-start trunks. The E-E position is for End-to-End operation, usually as a

PABX extension or C.O. End-to-End service. The E&M position is typically for PABX trunks using E&M, 2-wire audio signaling. In the GND ST position, the interface is for PABX ground start trunks.

Two detectors are used on each of the two telephone lines: a loop detector and a ring detector. The ring detectors are used when in the End-to-End configuration. The loop detectors are used with loop-start, ground-start, and E & M lines. R57 and R59 set the threshold of the Trunk A loop detector. R64 and R66 set the threshold of the Trunk B loop detector. The rest of the telephone line control consists of a current-limited 48-volt power supply; DS15, DS16 and C2 for Trunk A, DS13, DS14 and C3 for Trunk B, and relay control.

Full-duplex hybrids separate the incoming and outgoing audio. The circuitry effectively cancels out the outgoing audio from the incoming audio. Part U26 for Trunk A and U27 for Trunk B form inductor and variable capacitor simulators to model the impedance of each telephone line and transformer. Each trunk is provided with two adjustments: R Balance and C Balance. These balance controls are used to “match” the hybrid to the telephone lines. The better the match, the better the isolation provided.

Trunk A incoming audio is amplified by U28 and level adjusted by R17. Trunk B incoming audio is amplified by U4 and level adjusted by R9. The amplified outputs are then fed into the Envelope Detector, AGC, Modem, and DTMF decoder for each trunk. Trunk A's Envelope Detector consists of U28 and associated components. The voltage across C53 is connected to an analog input of the microprocessor U14. Trunk B's Envelope Detector consists of U4 and associated components. The voltage across C12 is connected to an analog input of U14, as well. The detect threshold is a programmable parameter due to this use of the microprocessor's analog to digital inputs.

The AGC circuits for trunks A and B use their respective envelope detector outputs. Each is comprised of a FET and a peak detector. The varying source-drain voltage of the FET introduces distortion which is minimized by feedback from U28 (U4 for trunk B). The peak detector's threshold determines the nominal peak to peak output level the AGC will attain. The output of each AGC is applied to the PCM Combo CODECs, U8 for Trunk A, and U5 for Trunk B.

The paging software communicates with the Dual Trunk Card microprocessor through the dual-port RAM U35. The RAM appears in the I/O map of the system when the card is “selected”. U33 and a portion of U37 make up the select circuitry. Each card has a unique select address determined by the setting of the DIP switch SW2. The card becomes NOT selected when any other card is selected; thus, only one card is present in the IBM I/O map. The reset line of the microprocessor can be controlled by the IBM bus via a portion of U37. SW1 is a push-button switch that creates a non-maskable interrupt used for testing purposes.

## Dual Trunk Card — 4-Wire E&M (702-9318)

This card is physically very similar to the standard Dual Trunk card. In fact, it uses the same printed circuit board. The difference is that it also has a daughter board mounted on it that provides the appropriate interface for 4-wire audio.

This card is only used with 4-wire E&M trunk lines. The control functions of the “E” and “M” leads are the same as they were for a 2-wire E&M trunk. The 4-wire audio allows the use of a separate pair for both the receive and transmit audio. This means better audio during calls and less work installing and maintaining the line.

Unlike the standard Dual Trunk card, this card may not be used for any other line type.

## Multiport Serial Card (702-9191)

The Multiport card is basically a Dual Trunk with the telephone line portions deleted, and serial ports substituted.

This card handles from 1 to 8 serial ports. (See separate section for installation & operation information). The incoming serial lines for the ports come through MC14506 RS-232 driver chips, which provide buffering and signal conditioning for both in- and out-bound signals. Two data and two handshaking lines are used for each port (although the software does not currently use the handshaking lines).

The serial lines then go from these chips to 2681 Dual UART chips. These DUARTs have two independent UARTs (Universal Asynchronous Receiver/ Transmitter) in them. Each port can have its own baud rate, word size, etc.

These DUART chips then interface directly to the Multiport card microprocessor's data, address, and control busses.

The Multiport card's microprocessor is comprised of a Motorola 68HC11 processor, static RAM, EPROM, and various “glue” chips.

The interface to the main paging system is through a dual-port RAM, the same as the Dual trunks.

# Dual Dial Click Option (for 702-9117)

In some rural areas, DTMF (tone) dialing is not normally available or used. This makes it difficult to use the Model 2200 on end-to-end telephone lines and require the caller to dial in the pager number. All that comes through from a rotary dial telephone is audible clicks from the telephone's contacts opening and closing as the dial turns. This type of telephone can be supported on the Terminal by adding the Dial Click Detector option board and companion software.

For use with rotary dial telephones, the telephone system must pass residual audio clicks of the dial turning, without disconnecting the caller. The optional “dial click” detector, with special software converts these clicks into a usable pager number. This conversion process generally works, but each installation should be tested before having callers rely upon overdial click interpretation. Note that most electronic “Universal Dial” phones with FET loop current interrupters do not provide clicks that are sharp enough to be passed through phone equipment.

The dial click detector processes the incoming audio clicks from the telephone line and converts them into high/low digital pulses that are read by software. Since dials turn at different and varying speeds, and sometimes produce extra clicks during their rotation, the software is designed to be extra smart in interpreting these clicks and converting them back into the 0-9 digits dialed by the caller. The process is not 100% perfect and it is strongly advised that dialing via several different phone company central offices should be attempted before assuring subscribers that their paging will always work correctly. If dial click detection proves unsatisfactory, a DID (direct inward dial) line will be needed to page reliably from rotary telephones.

The Dual Dial Click card performs the detection function on two separate audio channels for Dual Trunk Card applications. The Dual Dial Click card processes two audio channels and produces a separate logic 1 output for each click of audio from the corresponding telephone input.

Trunk A audio comes in on J5 pin 7 and the resulting digital signal is output to J5 pin 8. Trunk B audio comes in on J5 pin 9 and the resulting digital signal is output to J5 pin 10. Each channel of audio passes through its own band-pass filter to remove any speech component and properly shape the pulses. The filter for trunk A is built around half of U2 and the filter for trunk B is built around half of U5. Variable gain amplifiers (Trunk A - half of U1, Trunk B - half of U4) allow for field adjustment of the filter output to a constant peak level.

The output of these amplifiers is full-wave rectified by the other halves of U1 for Trunk A and U4 for Trunk B. The resulting waveforms are used to drive the comparators comprised of half of U2 for Trunk A and half of U5 for Trunk B. The outputs of the comparators are inverted via transistors Q1 for Trunk A and Q2 for Trunk B. The inversion results in a digital logic 1 being present on the corresponding output pin whenever a dial click is detected. The comparator outputs also drive detector lamps DS1 (Trunk A) and DS2 (Trunk B).

# MF Decoder Option

When activated by the Dual trunk software, and enabled in the configuration settings, the 78A207 MF decoder chips on the MF board will generate an interrupt to the Dual Trunk's CPU when an MF tone pair is decoded. The CPU reads the MF board's status to determine which half of the dual trunk generated the interrupt, and which MF tone pair was received.

The MF board can also generate MF tones, using an 87C751 and a DAC. The MF tone frequencies are listed in Table 18. For comparison, the standard DTMF tone frequencies are listed in Table 19.

# Station Card

The Station Card provides interface to the transmitter or transmitter controller. The Station Card is responsible for making the paging tones, directing the voice to and from the PCM highway and providing the necessary inputs and outputs to control the transmitter(s).

## Station Card II (702-9441)

This version of the station card takes advantage of advances in IC design and components in general since the original station card was designed.

The CODEC in U19 handles sending voice audio both to/from the PCM data bus and to the transmitter. The amplitude of transmitted voice audio is set with R9.

The paging tones are produced by U7 and RP3. The amplitude of the transmitted tones is set with R8.

This card provides a high-stability oscillator for digital paging. As a result, it also provides better “batching” performance than the previous model of station card.

*Table 20: MF Signaling Tone Frequencies*

| Code | Name | Tone Pair Frequencies |
|---|---|---|
| 1 | 1 | 700, 900 |
| 2 | 2 | 700, 1100 |
| 3 | 3 | 900, 1100 |
| 4 | 4 | 700, 1300 |
| 5 | 5 | 900, 1300 |
| 6 | 6 | 1100, 1300 |
| 7 | 7 | 700, 1500 |
| 8 | 8 | 900, 1500 |
| 9 | 9 | 1100, 1500 |
| A | 0 | 1300, 1500 |
| B | KP | 1100, 1700 |
| C | ST | 1500, 1700 |
| D | ST1 | 900, 1700 |
| E | ST2 | 1300, 1700 |
| F | ST3 | 700, 1700 |
| 0 | — | no tone |

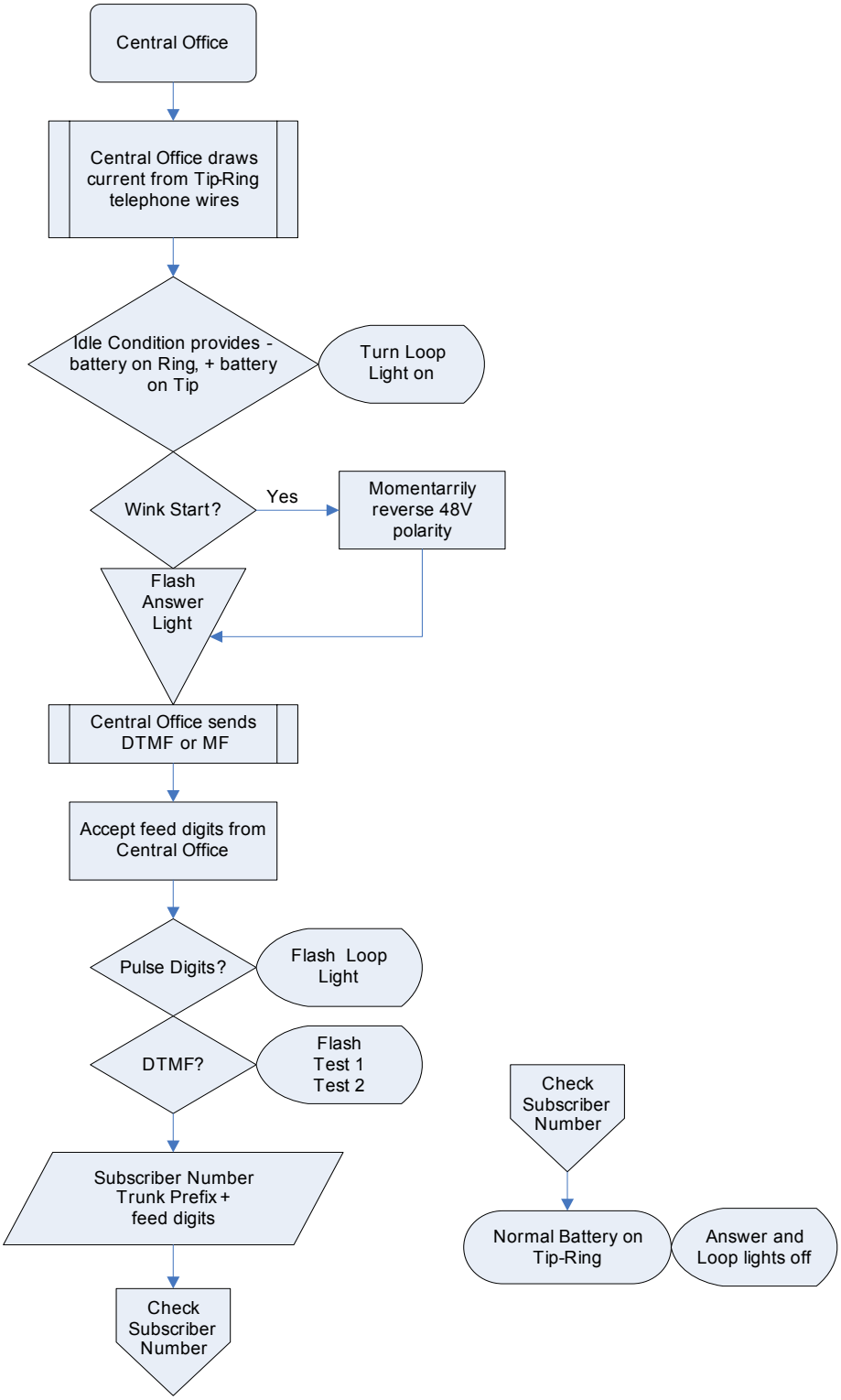
*Table 21: DTMF Signaling Tone Frequencies*

| Key | Tone Pair Frequencies | Key | Tone Pair Frequencies |
|---|---|---|---|
| 1 | 697, 1209 | 9 | 852, 1477 |
| 2 | 697, 1336 | * | 941, 1209 |
| 3 | 697, 1477 | 0 | 941, 1336 |
| 4 | 770, 1209 | # | 941, 1477 |
| 5 | 770, 1336 | A | 697, 1633 |
| 6 | 770, 1477 | B | 770, 1633 |
| 7 | 852, 1209 | C | 852, 1633 |
| 8 | 852, 1336 | D | 941, 1633 |

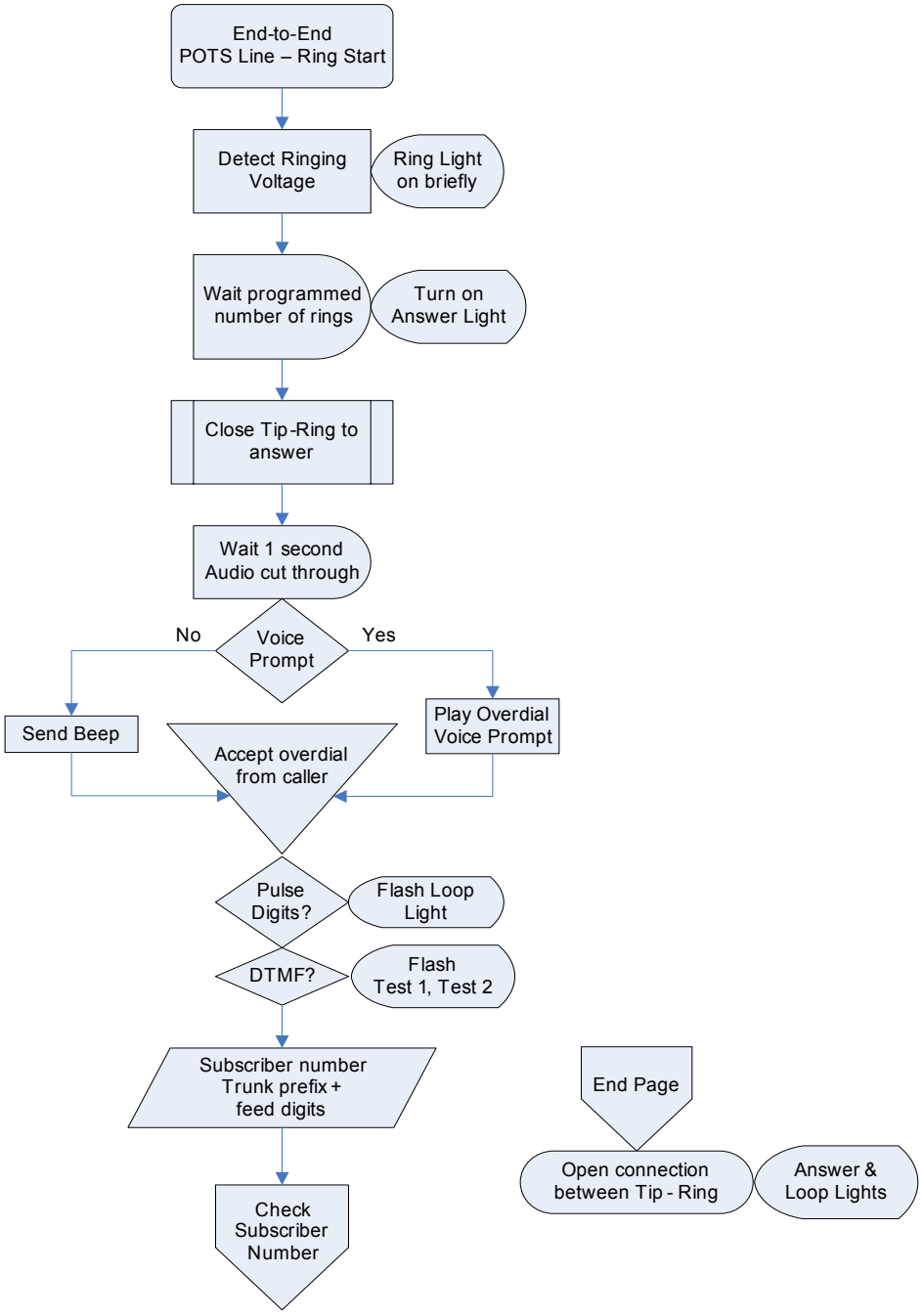
## Call Processing Flow Charts

The following flow charts describe the sequence of events when a telephone caller accesses the Paging Terminal. Start with the flowchart for your particular kind of telephone interface. Note that options such as PageSaver(tm), System Voice Prompts, and Client Personalized Greetings alter the flowcharts in small ways.

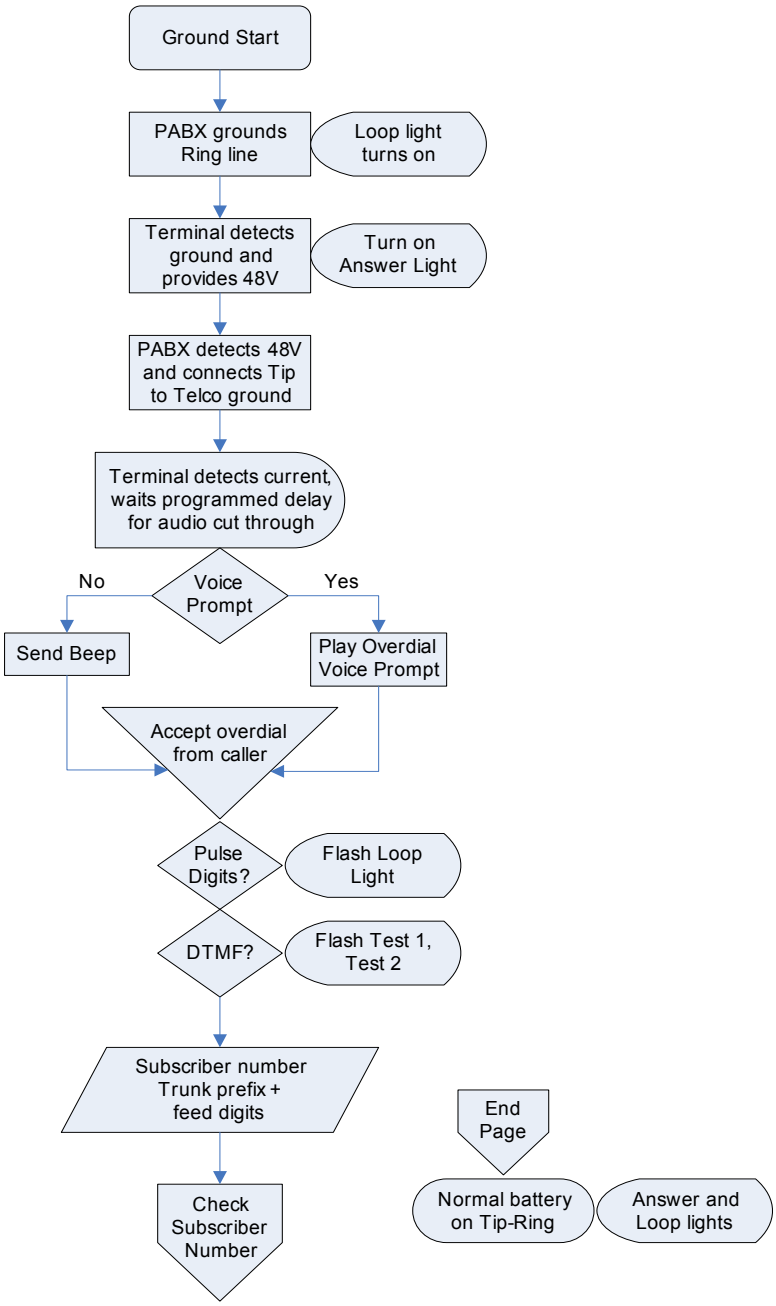
## Central Office DID (Selector Level)


Central Office
Central Office draws current from Tip-Ring telephone wires
Idle Condition provides - battery on Ring, + battery on Tip
Turn Loop Light on
Wink Start?
Yes
Momentarrily reverse 48V polarity
Flash Answer Light
Central Office sends DTMF or MF
Accept feed digits from Central Office
Pulse Digits?
Flash Loop Light
DTMF?
Flash Test 1 Test 2
Subscriber Number Trunk Prefix + feed digits
Check Subscriber Number
Check Subscriber Number
Normal Battery on Tip-Ring
Answer and Loop lights off

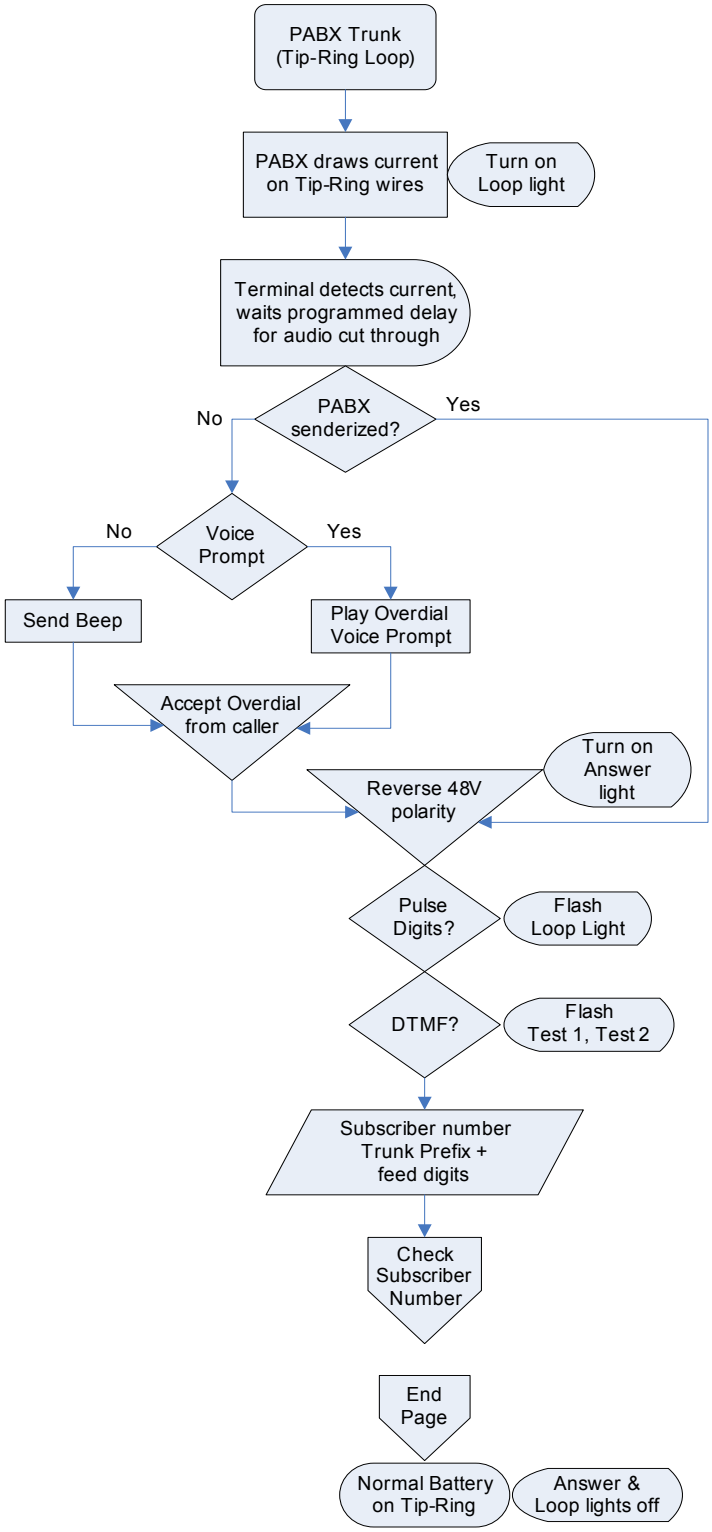
## End-to-End Loop Start (Central Office/PABX Station)



## End-to-End Ground Start (PABX Trunk)

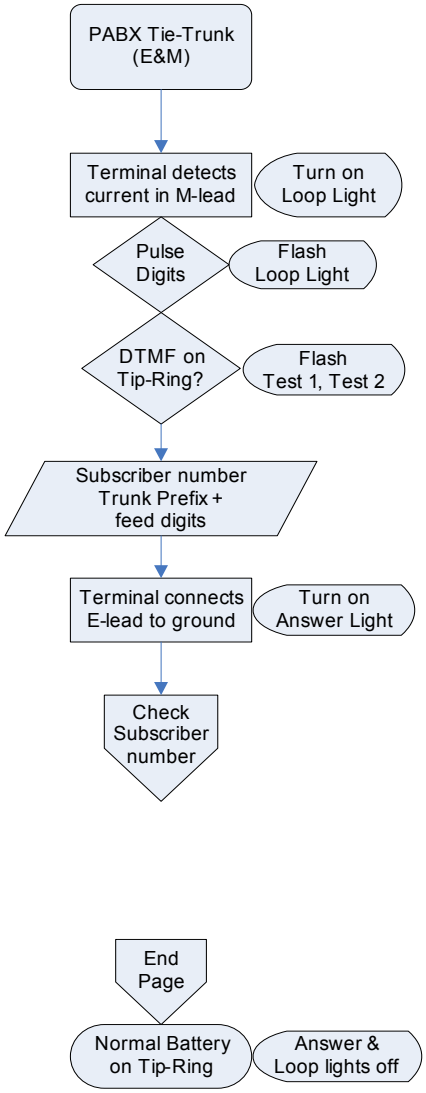


## PABX Trunk (Tip-Ring Loop)

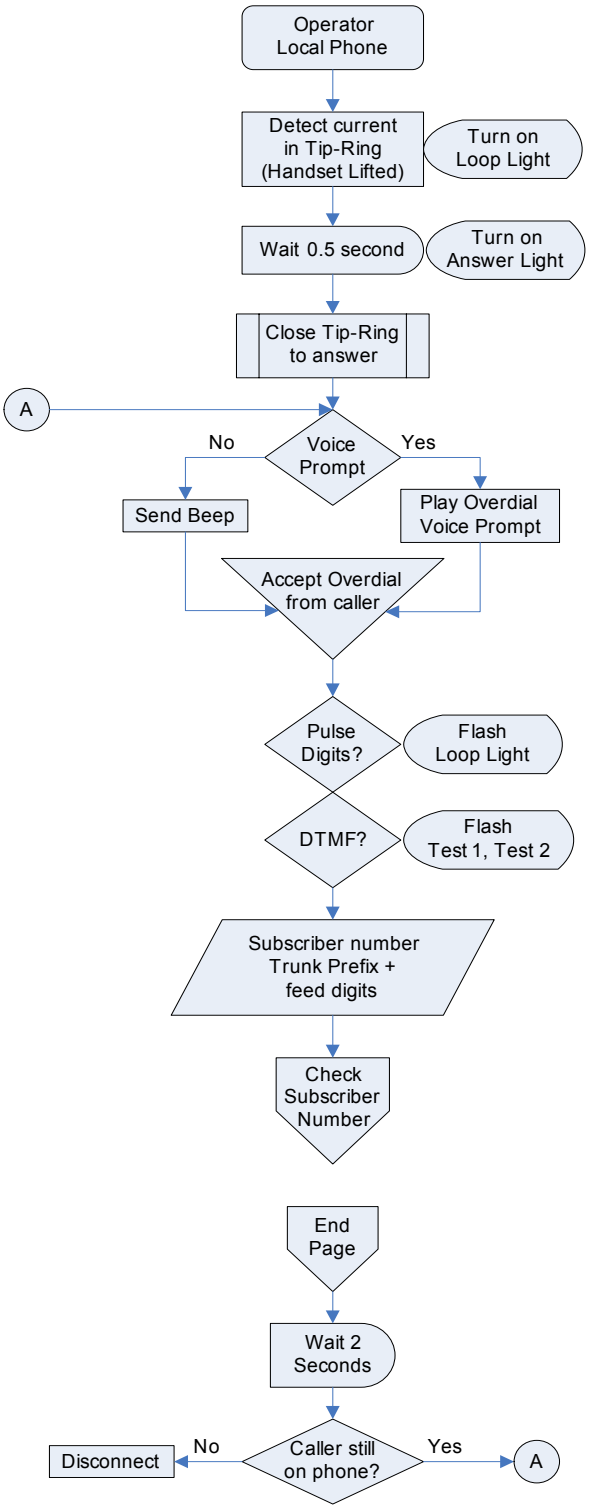


## PABX Tie-Trunk (E&M)

**(Reverse signaling available)**



## Operator Local Phone



**Note** Flowcharts for Alpha, Group, Voice Prompts, and PageSaver$^{tm}$ are described in the Operating and Programming Manual (025-9034).

# TELCO Signal Descriptions

The interface signals between the telephone switching system and the Model 2200 and 2100 are used for different purposes on different types of telco circuits. The following charts describe the signals used for each telephone equipment type.

## Central Office DID (Selector Level)

| Signal Name | Purpose |
|---|---|
| RING | Paired with TIP signal<br>Carries loop current for circuit supervision and balanced audio |
| TIP | Paired with RING signal<br>Carries loop current for circuit supervision and balanced audio |
| E | Not used |
| M | Not used |
| Chassis GND | Protective earth ground |

## Central Office End-to-End

| Signal Name | Purpose |
|---|---|
| RING | Paired with TIP signal<br>Carries 105VAC ringing voltage, loop current for circuit supervision, and balanced audio |
| TIP | Paired with RING signal<br>Carries 105VAC ringing voltage, loop current for circuit supervision, and balanced audio |
| E | Not used |
| M | Not used |
| Chassis GND | Protective earth ground |

### PABX E&M Type I Tie-Trunk (2-wire audio)

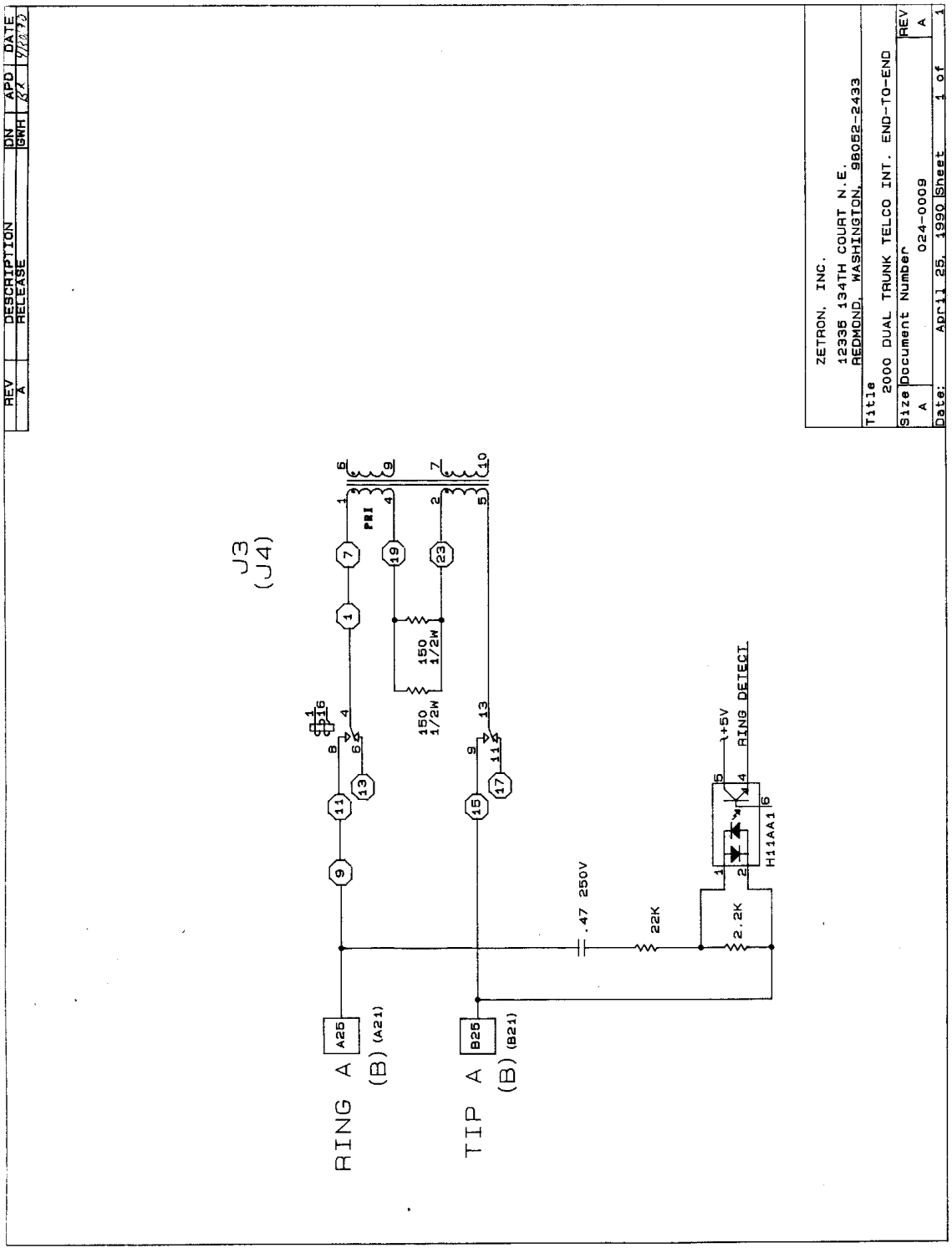
| Signal Name | Purpose |
|---|---|
| RING | Paired with TIP signal. Carries balanced audio |
| TIP | Paired with RING signal. Carries balanced audio |
| E | Paired with M signal<br>To telco system to answer and terminate telephone call |
| M | Paired with E signal<br>From telco system to originate and terminate telephone call |
| Chassis GND | Protective earth ground<br>Carries return current for E and M signals |

## Simplified TELCO Configuration Schematics

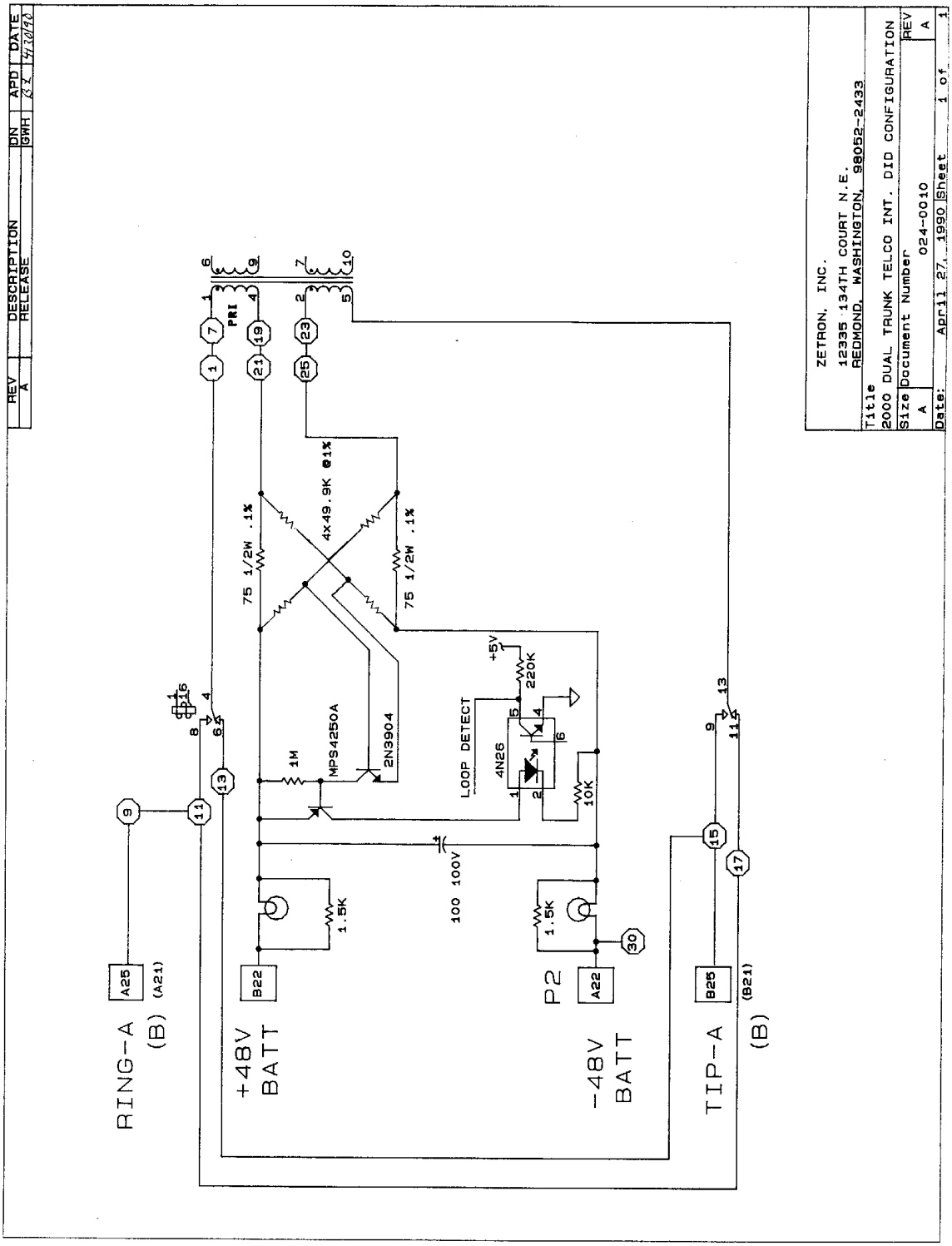
The following diagrams are simplified schematics of the four standard telco interfaces. In conjunction with the previous text descriptions, they can help you and your telephone service provider understand the telephone interface.

The Answer relay is shown in idle condition in these schematics (no call in progress).

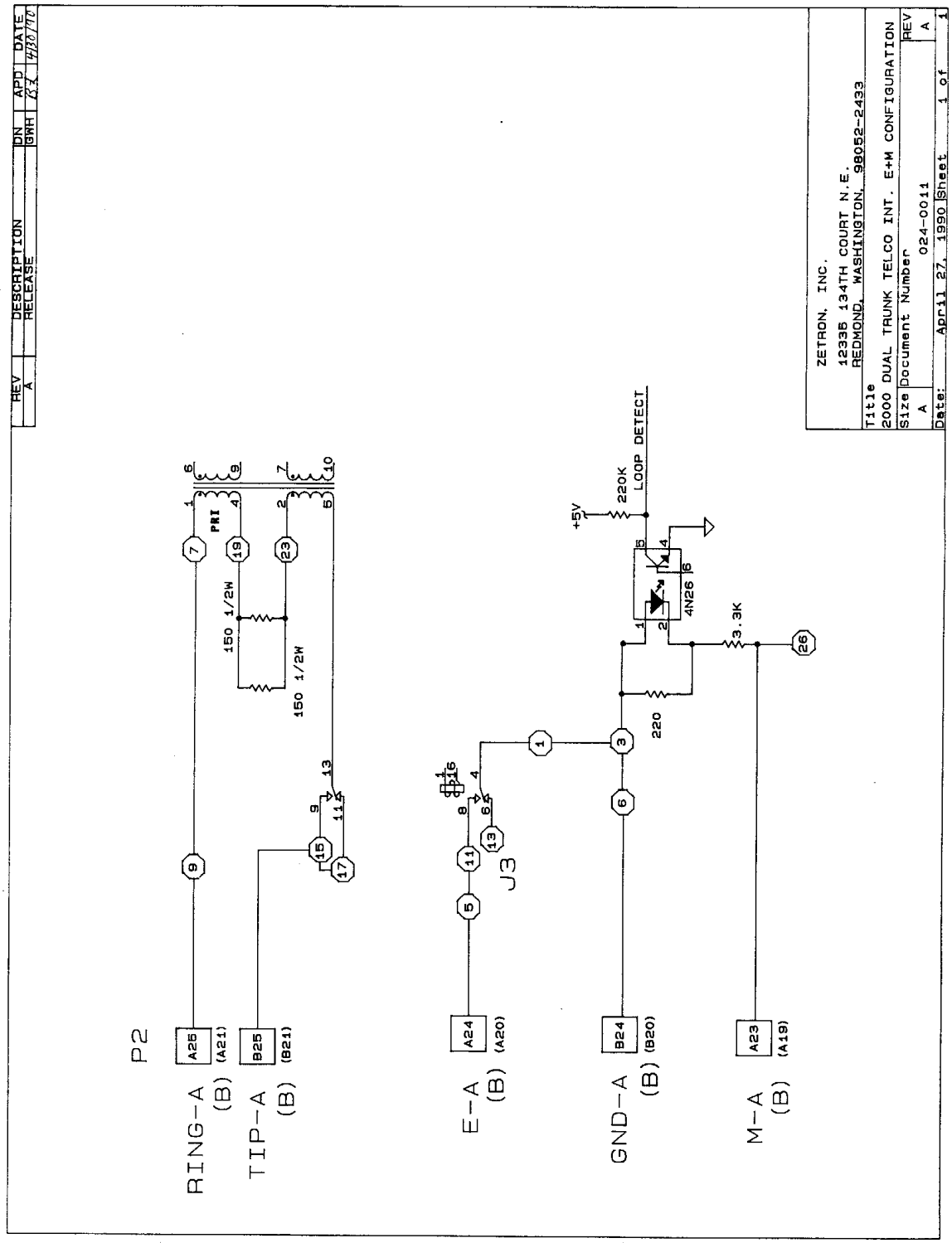
## End-to-End Configuration (024-0009A)



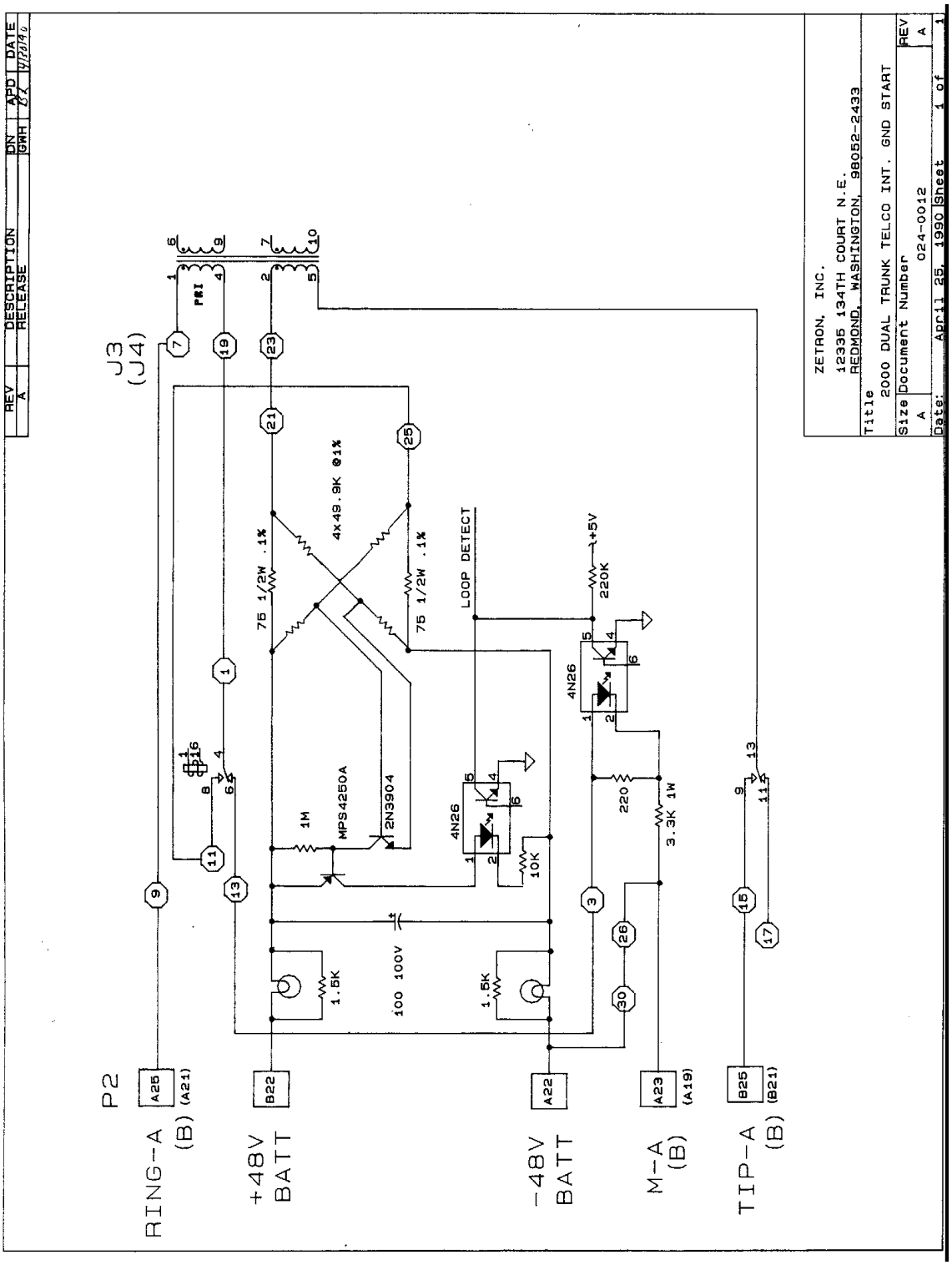
## DID Configuration (024-0010A)



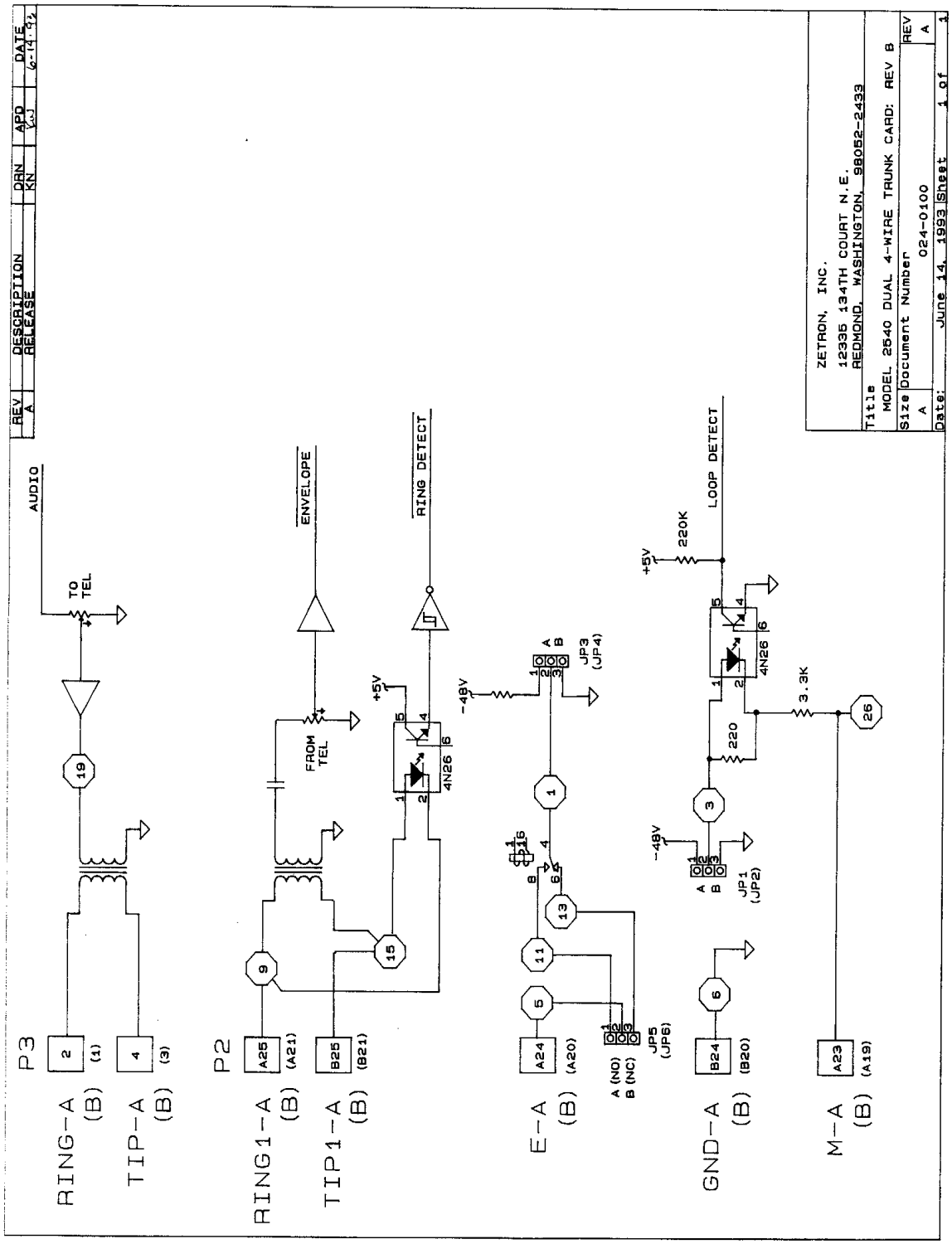
## E&M Configuration (024-0011A)



## Ground Start Configuration (024-0012A)



## Dual 4-wire Configuration (024-0100A)



# TELCO Interface Timing Diagrams

These diagrams show the relations between the various interface signals of the Trunk Card (702-9117) and the Telco System. The names and the timing values are described in *Trunk Card OPARAM Codes* on page 219. There are separate diagrams for each type of telephone circuit configuration.

*Figure 32: Central Office DID (Immediate Dial Pulse) Call Initiation and Termination*

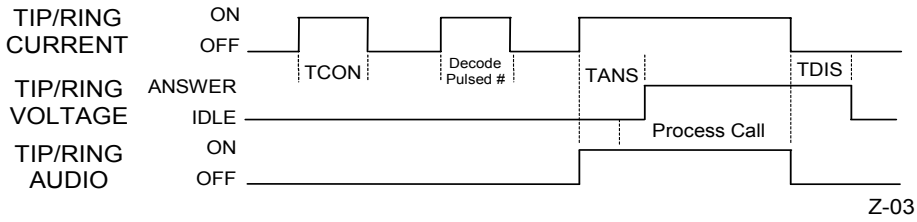
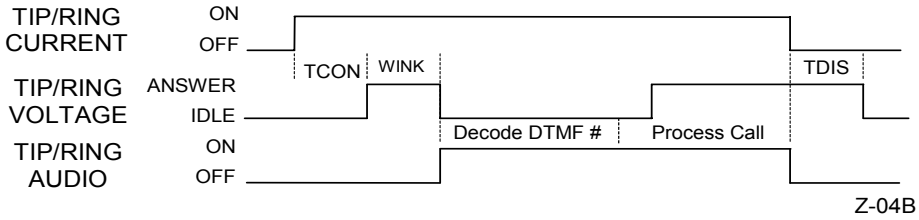



*Figure 33: Central Office DID (Wink Start DTMF) Call Initiation and Termination*




**Note** WINK can be set in OPARAMS (Zetron software), 240 milliseconds is typical.

*Figure 34: PABX Trunk (Loop Start) Call Initiation and Termination*

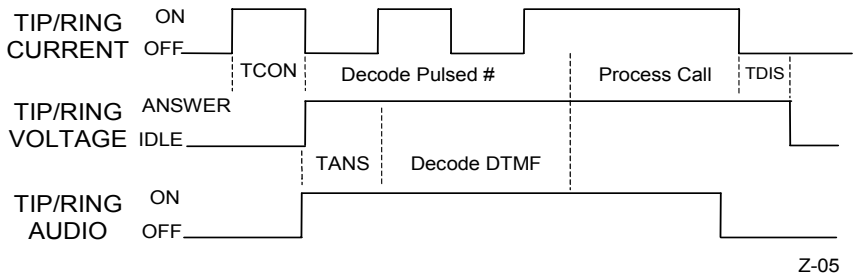


*Figure 35: Operator Local Phone Call Initiation and Termination*

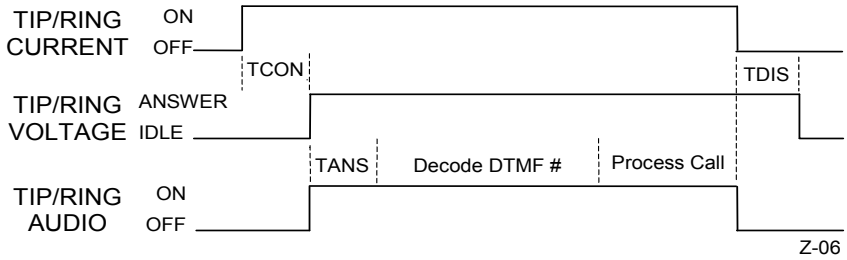



*Figure 36: Central Office End-to-End and PABX Station Extension Call Initiation and Termination*

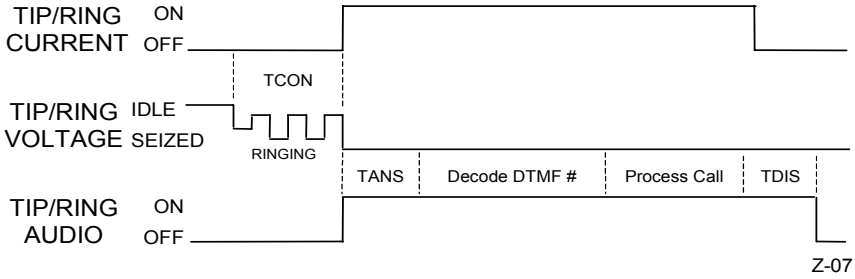



*Figure 37: PABX E&M Type I Tie-Trunk Call Initiation and Termination*

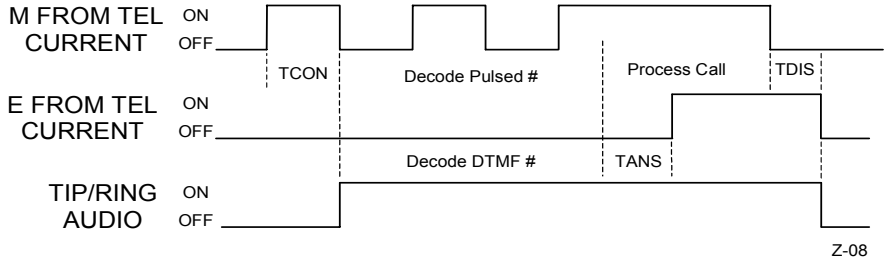
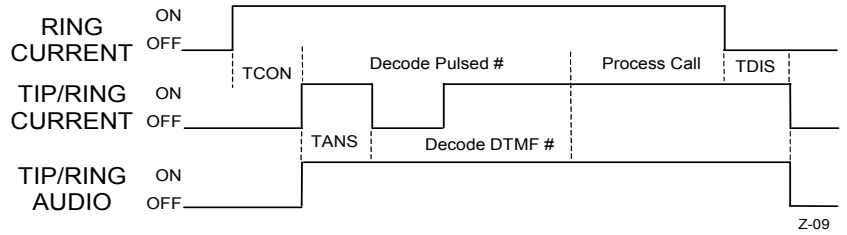


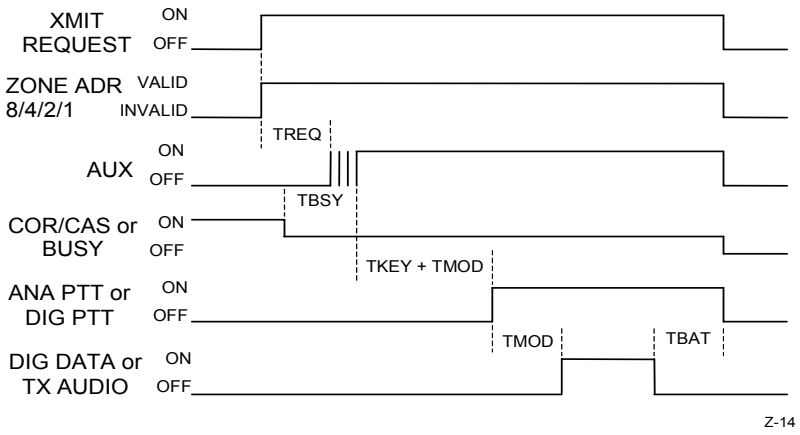

*Figure 38: PABX End-to-End Ground Start Call Initiation and Termination*



# Radio Interface Timing Diagrams

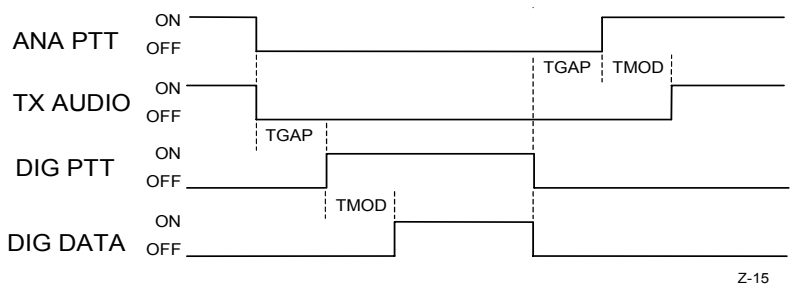
These diagrams show the relationship between the interface signals of the Radio Interface card and the Radio Station. Signal names are described in the Radio System section. Timing values are described in the System Configuration Files section. The first three diagrams show control mode without a TX link controller unit (parameter 07 Remote Control Mode in `oparam.cds` is not 04).

*Figure 39: Key Up Sequence (Remote Control Mode = 00, 01, or 02)*




**Note** ZONE ADR remains set to last zone keyed until next paging message

*Figure 40: Mode Change from Analog to Digital and Back (Remote Control Mode = 00, 01, or 02)*




**Note** The AUX PTT relay stays on during digital to analog or analog to digital mode changes.

*Figure 41: New Zone Selected While Keyed (Remote Control Mode = 00, 01, or 02)*

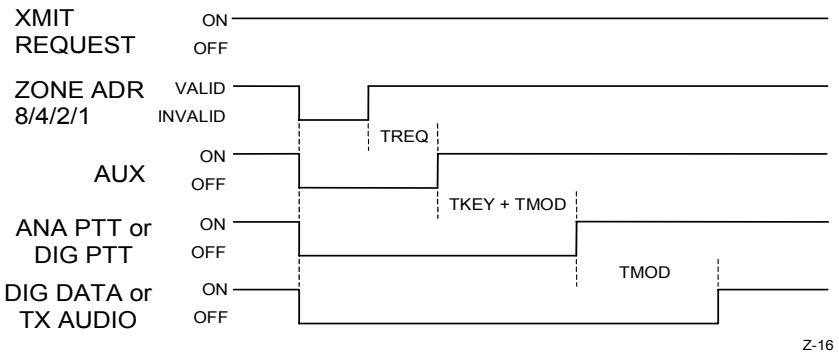
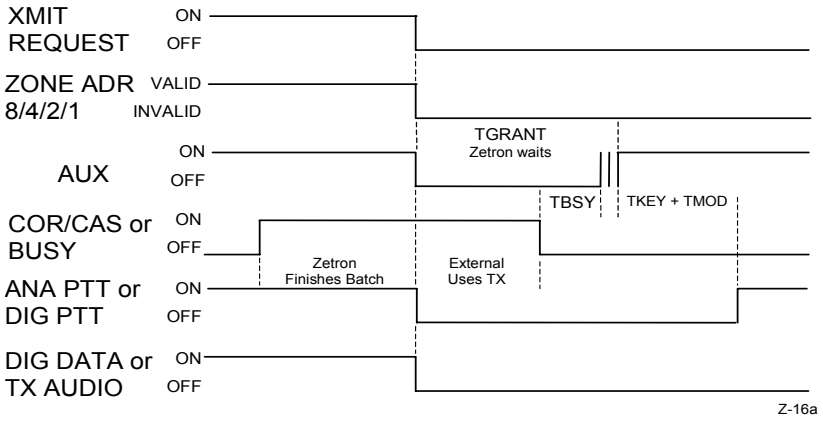



*Figure 42: External Equipment requests with BUSY (Remote Control Mode = 00, 01, 02)*

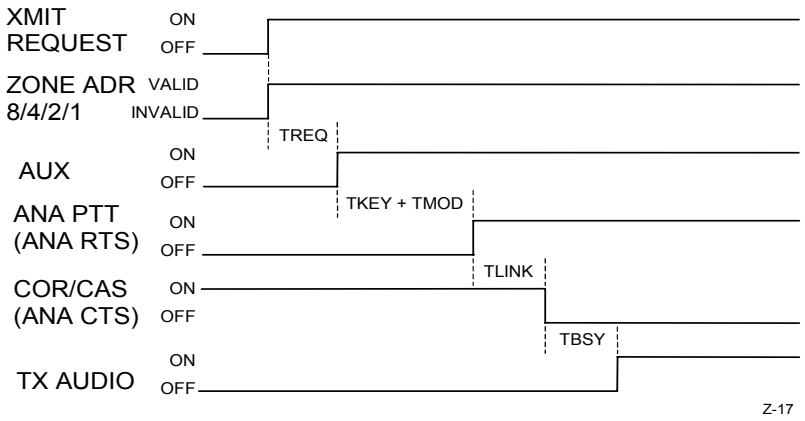



**Note** TBAT = batch scanning time, approximately 2 seconds ZONE ADR remains set to last zone keyed until next paging message.

## Timing Diagrams for External TX Control Unit

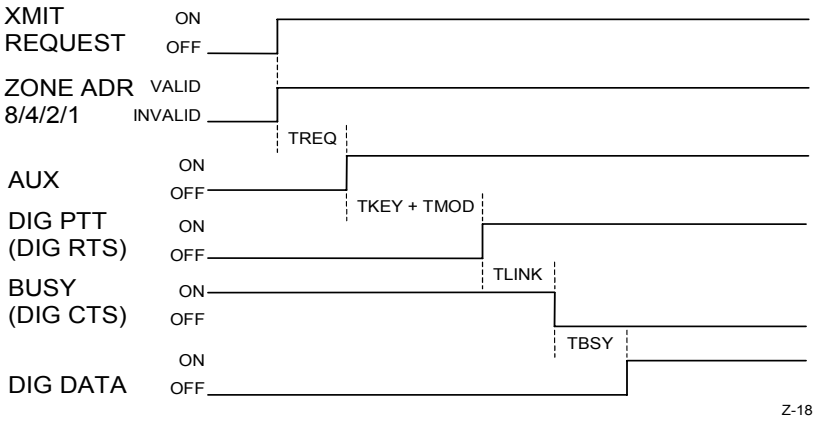
The following diagrams show the timing for use with an external transmitter control unit such as the Motorola PSC or SSC. They specially require the overlap in time of the PTT signals so the remote station does not unkey. In addition, the signal names COR/CAS and BUSY take on new meaning since they are used for handshaking with the control unit. The Remote Control Mode parameter 07 is programmed to a value of 04 in `oparam.cds`.

*Figure 43: Key Up Sequence Analog Mode (Remote Control Mode = 04)*




**Note** TLINK is the sum of the TX link delay, the remote TX keyup delay, and the simulcast compensation; all generated by the control unit.

*Figure 44: Key Up Sequence Digital Mode (Remote Control Mode = 04)*




**Note**

1. TLINK is the sum of the TX link delay, the remote TX keyup delay, and the simulcast compensation; all generated by the control unit.

2. Remote Motorola PURC stations require DIG DATA to begin transitions within 150 milliseconds after receiving the DIG PTT signal. Therefore, TBSY + link delays to get the data to the remote TX, must be less than this 150 milliseconds. So, program TBSY very small in oparam.cds.

*Figure 45: Mode Change from Analog to Digital and Back (Remote Control Mode = 04)*

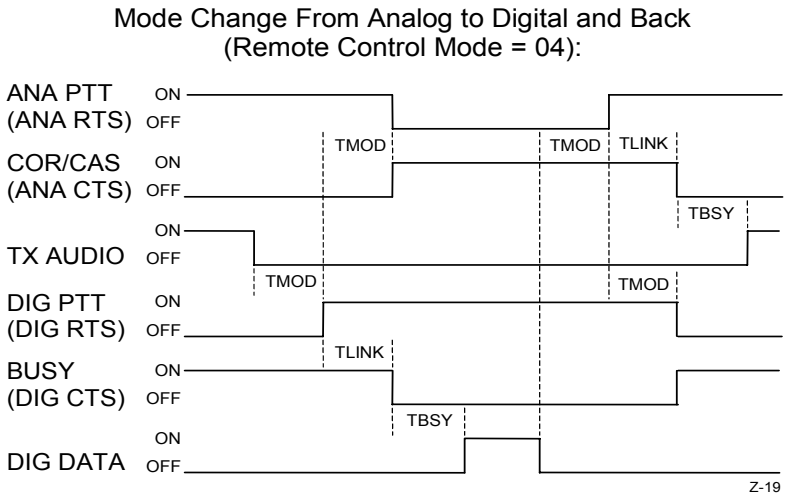
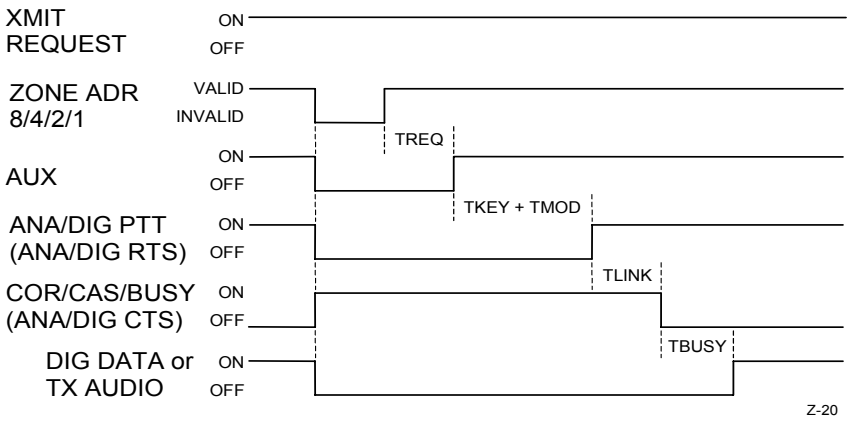



*Figure 46: New Zone Selected While Keyed (Remote Control Mode = 04)*




**Note** ZONE ADR information changes as soon as Radio Station Card selects next zone for paging.

# Troubleshooting and Repair Procedures

This section contains some troubleshooting procedures that may help you if you encounter any difficulties in operating the paging terminal. The information provided covers symptoms/remedies, front panel lamp indications, progress tones, and the office computer.

## Troubleshooting the Paging Terminal

Use the following table to help in isolating and correcting problems that may appear with the paging terminal.

| SYMPTOM | PROBLEM | SOLUTION |
|---|---|---|
| Trunk will not answer End to End trunk line, Ring light does not light | Matrix not configured<br><br>Trunk not wired to lines<br><br>Telco problems | Verify matrix configuration<br><br>Verify punchdown block wiring<br>Verify J19 or J20 plugged in<br><br>Verify lines with telephone wired at punchdown block |
| Same as above, Ring light lights | Operating parameters not correct | Check printout of OPARAM.CDS |
| Loop LED lights but no digits from CO on DID lines, silence on phone | Terminal not configured for Wink<br><br>CO sending MF, not DTMF | Check printout for type of DID line, change if needed<br><br>Change CO service to DTMF or pulse dialing; or order our MF option |
| Loop LED blinks but no digits from CO on DID lines, busy on phone | Tip, ring reversed | Reverse trunk tip/ring |
| Hear Whooping sound calling DID line | Receiving invalid digits from CO | Check printout for legal digits, change if needed |

| SYMPTOM | PROBLEM | SOLUTION |
|---|---|---|
| Trunk answers overdial line but busies out after pager # entry or after answering DID line | No database (D.B.) | Download database |
| | Subscriber ID incorrect | Check printout for translation of telephone numbers |
| | Subscriber status not Valid | Verify status field in database is "V" |
| | Not enough digits | Check printout for digits of feed |
| Busy tones before true end of paging | From Tel Level too low | Increase appropriate FROM TEL adjustment |
| # and Trunk TEST1 or 2 does not blink | Phone system not passing overdial | Listen to phone line to verify DTMF or clicks |
| | Calling from pulse phone | Equip terminal with Dial Click card or adjust dial click card |
| Accepts pager #, or call from DID line, but busy signal after or during display message entry | Terminal was expecting Function Code | Enter legal function code or do not program for Caller Entered Function Codes |
| | Phone system not passing overdial | Listen to phone line to verify DTMF or clicks |
| | Calling from pulse phone | Equip terminal with Dial Click card or adjust dial click card |
| Accepts display message but no transmission | Subscriber programmed for wrong channel | Edit subscriber channel # |
| | Subscriber programmed with illegal Func. Code | Edit legal function code |
| | Display format option not ordered | Order option from Zetron |
| | Voice and display limit both programmed nonzero | Only HSC allows both display and voice |
| | COR or Terminal Busy on | Fix connection to Station card |

| SYMPTOM | PROBLEM | SOLUTION |
|---|---|---|
| Transmits page but pager does not alert | Incorrect capcode | Edit subscriber capcode Double check 2 tone frequency with reeds in pager |
| | Incorrect function code | Edit subscriber function code |
| | Insufficient R.F. dev. | Adjust Station XMIT TONE pot for 3.5 kHz tone deviation Adjust Transmitter digital deviation to 4.5 kHz |
| | R.F. freq. off | Adjust Transmitter center frequency to pager's |
| | Digital Polarity | Change Oparam parameter |
| Pager alerts but display garbled | Alpha info to numeric pager | Edit subscriber Alpha field |
| | Incorrect function code | Edit subscriber F.C. field |
| | Insufficient R.F. deviation | Adjust Station XMIT TONE pot for 3.5 kHz tone deviation Adjust Transmitter digital deviation to 4.5 kHz |
| Pager alerts but missing characters on display | Insufficient DTMF level | Adjust Trunk FROM TEL pot |
| Pager sometimes does not alert | Insufficient R.F. deviation, R.F. frequency off | Adjust Station XMIT TONE pot for 3.5 kHz tone deviation Adjust Transmitter digital deviation to 4.5 kHz |
| | Insufficient Tone duration | Edit 2-Tone tone duration |
| Hum or buzz during voice page | Over deviation | Reduce Station XMIT AUDIO |
| | Telco line imbalance | Remove 48V ground jumper Call CO |
| Too much background noise during voice page | Over driving transmitter | Reduce Station XMIT AUDIO |
| | Trunk AGC too hot | Adjust Trunk FROM TEL pot |
| Voice quiet at first then increases during voice page | Hybrid not balanced | Adjust Trunk BAL R,C |
| Not detecting * override during voice prompt | Hybrid not balanced | Adjust Trunk BAL R,C |
| | Telephone transmits timed DTMF | Verify telephone puts out DTMF long as pushing button |
| Zetron CPU LEDs strobe continuously, rapidly, from top to bottom | Boot failure | Check power supplies; swap in spare hard disk |

### Swapping Cards

The technique of swapping cards is a good one for isolating problems. One must be careful when juggling cards around to avoid creating other problems, though. A few things to keep in mind are presented here. To swap two cards, just remove the cards and switch the DIP switch settings. If you are swapping Trunk cards, be sure the "matrix circuit" is set right.

## Front Panel Lights

The front panel lights indicate the status of hardware and software signals in the system and can give you valuable information when troubleshooting system operation. The chart below outlines the meaning of the lights labeled **SELECT**, **TEST**, **TS** or **T** which relate to communication between the CPU and the microprocessors on the interface cards. As different parts of the paging software come into action, the lights act in different ways as outlined in the following table.

| Software Step | Card | Lights | Action |
|---|---|---|---|
| Power On | CPU | T1 - T4,<br>COM A,<br>COM B,<br>MDM, TMP<br>FLT | All on |
| CPU Test | CPU | T1 - T4,<br>COM A,<br>COM B,<br>MDM, TMP<br>FLT<br><br>DMA or EMS | All go on for 20-25 seconds, then all except FLT go off then flash on and off once. Finally, all go dark.<br><br>Off for 15-20 seconds, then flashes. |
| Reset Cards<br>(2 seconds) | Trunk<br>Dual Trunk<br>Station | TEST1-3, MODEM<br>TEST1-3<br>TEST1-3, REQ, DATA | On-Off-On<br>On-Off-On<br>On-Off-On |
| Firmware sent to cards<br>(2 minutes) | Trunk<br><br>Dual Trunk<br><br>Station | SELECT<br>TEST3<br>SELECT<br>TEST3<br>SELECT<br>TEST3 | On<br>Winking<br>On<br>Winking<br>On<br>Winking |
| Paging system polling | Trunk<br>Dual Trunk<br><br>Station | SELECT, TEST3<br>SELECT<br>TEST3<br>SELECT, TEST3 | Winking<br>Winking<br>Double winking<br>Winking |

| Software Step | Card | Lights | Action |
|---|---|---|---|
| New telco call | Trunk | RING<br>LOOP<br>LOOP<br>ANSWER<br>TEST1 | On for end-end call<br>Blink for DID pulse<br>On for DID DTMF<br>Wink for DID DTMF<br>Digit decoding |
| New telco call | Dual Trunk | RING<br>LOOP<br>LOOP<br>ANSWER<br>TEST1<br>TEST2 | On for end-end call<br>Blink for DID pulse<br>ON for DID DTMF<br>Wink for DID DTMF<br>Digit decoding Trunk A<br>Digit decoding Trunk B |
| Active telco call | Trunk | LOOP, ANSWER<br>TEST2<br>TEST3 | On<br>On = audio on FROM TEL<br>On |
| Active telco call | Dual Trunk | LOOP, ANSWER<br>TEST1<br>TEST2<br>TEST3 | On<br>On = audio from Trunk A<br>On = audio from Trunk B<br>On |
| New paging cycle | Station | REQUEST<br>COR or TERM BUSY<br>ZONE1,2,4,8 | On<br>Depends upon radio signals<br>Depends upon paging zone |
| Active paging | Station | ANA PTT<br>DIG PTT, DATA<br>MODEM | On for paging tones or voice<br>On for binary digital paging<br>On for remote radio option |
| Modem ZlinkW Active | CPU | MDM | Mostly ON = data being transferred. Short flash ON every 3 seconds = connected but not transferring data. |
| Local ZlinkW Active | CPU | COM A | Mostly ON = data being transferred. Short flash ON every 3 seconds = connected but not transferring data. |

The paging software scans each interface card looking for incoming telephone calls from Trunk cards and outgoing paging from the Station cards. The SELECT and TEST3 light come on each card as the paging software transacts with a Station or Trunk card. It is normal to see the Trunk cards blink at a slower rate than the Station cards. It is also normal that one Station card's SELECT light may appear on solid. In fact, it is blinking at the same rate but for a longer period giving the illusion of being on solid.

For more details on lights and operation, see the section starting on page 71 for Trunk and Dual Trunk cards, see the section starting on page 97 for Station cards, see the section starting on page 151 for CPU/MASTER/MODEM/ASYNC cards, see the section starting on page 197 for Voice cards, and see the section starting on page 307 for Maintenance.

## Progress Tones

Knowing what the terminal is trying to tell you is very important when it does not do what you think it should. The sound of the prompt will tell you a lot, if not exactly, what is expected or what happened. The following table describes the various audible prompts of the Series 2000 paging Terminal.

| Audible Tones | Frequencies | Cadence | Meaning |
|---|---|---|---|
| Beep | 1000 Hz | 700 msec Once | Pager # for end-end or Voice message |
| Ring | 440 + 480 Hz | On = 2 seconds<br>Off = 2 seconds | Please wait |
| Di Di Dit | 1000 Hz | Di = 50 msec<br>Off = 50 msec | Numeric display message or enter Function Code |
| Dah Di Di Di Dit | 1000 Hz | Dah = 250 msec<br>Off = 35 msec<br>Di = 35 msec | Security passcode |
| Di Di Di Di Dit | 1000 Hz | Di = 50 msec<br>Off = 50 msec | Page accepted |
| Busy | 480 + 620 Hz | On = 500 msec<br>Off = 500 msec | Invalid subscriber Id, Page rejected, or Error |
| Fast Busy | 480 + 620 Hz | On = 250 msec<br>Off = 250 msec | End of telco call |

## DIP Switches and Matrix Plugs

The central software communicates to each of the peripherals through a unique address or port number. Each Trunk, Station, and Voice card must have its address or port DIP switch configured uniquely otherwise a bus contention will occur. While usually not damaging, the contention will only lead to confusion. Also refer to the “Switch Settings” sections on page 87 and page 105 for information on the DIP switches on the telephone trunk cards and the radio station cards.

Which station or trunk card receives what command or parameter is based on the setting of its DIP switch, not which slot it is plugged into (from the viewpoint of the PC-BUS, all slots are the same). It is possible to “fool” the system into thinking the station in slot 15 is really in slot 16 by swapping the DIP switch settings between these two cards. This example may result in pages destined for channel 2 go out on what used to be the station for channel 1.

You must be careful when doing these tricks because the operating parameters for a particular trunk or station may be different from others and not compatible with that

particular telephone line or transmitter. See the printout of your operating parameters to be sure.

Another variable to account for is the matrix plugs on the trunk cards. If you wish to swap a couple cards around, be sure the matrix is configured properly for that type of telephone line.

The general rule is that trunk and station cards have their DIP switch set to their slot number in binary. No two trunk or station cards should have their DIP switches set the same. The trunk cards should have their matrix jumpers set for the proper line type.

## Recommended Maintenance

From an operational or software standpoint, some active maintenance is recommended, to prevent running out of resources and otherwise noticing problems before your customers tell you about them:

- Make sure you regularly back up your ZbaseW subscriber data to multiple sets of backup disks, as described in the “Backup Systems” portion of the Subscriber Database section of the Operations manual.
- Check the Statistics (do Comm Stats) on a weekly or monthly basis; see the section on Statistics in the Operations manual. If the statistics for your trunks look wrong, the trunks.cus file establishes the trunk groupings - see the System Configuration Files section.
- ZlinkW password, or if you are using the ZbaseW Passwords capability: you may want to change the passwords occasionally for better security, especially when people leave your company.
- Do View Traffic often so you are familiar with your normal paging traffic.
- Be familiar with and use some of the more useful ZlinkW diagnostic commands (explained in the Remote Maintenance section of this manual).

There is little periodic hardware maintenance needed on the system:

- Keep it clean - blow out the dust and dirt every year or two. Especially near the fan and the slot openings in the covers and in the power supply area.
- The hard disk will die some day, but current hard disks have extremely long MTBF (mean time between failure) ratings, which means that your disk should usually last 5 years. You should consider getting a spare hard disk to have on hand before this day arrives.
- If your telephone lines are changed by the telephone company, you should recheck/readjust the hybrid balance. You may not necessarily know when they change equipment on their end of your telephone lines, so you may want to check this periodically.

- If you have had a system for years, and/or it is used in an environment with a corrosive atmosphere, you may want to periodically check and clean the contacts in the system - the backplane connector contacts and the mating gold fingers on the cards; the power supply Molex connector contacts; the RJ2EX connections to the phone lines and transmitters; and perhaps even the socketed ICs on the cards.
- Check with us occasionally for new features and capabilities that may be useful to you. The best way to do this is to make sure you subscribe to the Zetron Advantage newsletter.

## Troubleshooting the Office Computer

The office computer environment is the hardest for us to predict and control. Problems vary from incompatibility with modems to cables not correct for the application. Installation errors are reduced by using special installation programs so the installer need not know much about DOS, but problems still can occur. The following table contains information on isolating communication problems between the terminal and the office computer.

| Symptom | Problem | Solution |
|---|---|---|
| Error “no response...” | Comm port contention | Be sure the modem is configured for unique port number |
| | Modem not configured for “word result codes” | Check modem manual for DIP switch configuration |
| | Cable connecting to external modem not appropriate | The cable must pass pins 2,3,4,5,6,7,8,20 straight through |
| | Comm port set wrong in Locations database | Edit Locations database |
| Error “no carrier...” | Terminal's modem line not working | Verify plugged into modem (slot 2) wall or line jack Verify line with telephone |
| | Terminal not answering | Verify terminal is operating |
| | Phone # set wrong in Locations database | Edit Locations database |
| Computer calls, terminal answers, but “no carrier” | Modem not configured for “word results codes” | see above |
| | Modem not Hayes compatible | Use correct modem |

| Symptom | Problem | Solution |
|---|---|---|
| Computer calls, terminal answers, responds “connect” but no “ready” | Modem not Hayes compatible<br><br>Noisy or too quiet line | Use correct modem<br><br>Call terminal and listen to modem tone, try different phone lines or modem |
| Connects, but says “Access denied” | Password out of sync, typically due to using different computers with ZlinkW | Disable ZlinkW password temporarily. Turn switch 1 on the front of the Zetron CPU to the A position, then link up, then turn back to the B position |

# Additional ZlinkW Troubleshooting Information

The rest of this section covers connection between the office computer and the terminal. If you have successfully linked up to your terminal, you need not read it. Otherwise, please read through it before calling for assistance.

**Note** If you are using the Local Connect option, make sure your **Edit | Locations | Phone Number** field says **L4800**, not just **L**. The **L** by itself sets the baud rate to 1200. If the COMA/LCL LED on the CPU card flashes once, try assigning a different baud rate; for example**L9600**.

## General Information

Always turn off the computer or terminal before removing boards!

After changing any switch or jumper settings, turn the equipment off, then on, so the changes are recognized!

Your office computer (PC) can talk to the terminal through the telephone lines via modem (the standard method), or directly connected via serial ports (the Local connect option). If you use one method on your PC, you do not need the other.

**Note** Usually when you are asked to type a line into the computer, as shown in some steps below, you need to press Return (or Enter) for the computer to accept it.

## Office Computer

Our ZlinkW software is more sensitive to hardware configuration than terminal programs such as CrossTalk. ZlinkW may not work correctly, even when a terminal program runs

okay on the same machine without changing anything. The steps below should resolve any problem. Please note that, once configured properly for ZlinkW, other communications programs should still run without any problem.

Please note that ZlinkW resets both the serial port and modem when it starts up, to work properly with the 2000 Series terminals; there is no need to configure stop bits, parity, etc. manually - ZlinkW does it automatically.

## Serial Ports

If you have a Local connect option, or an external modem, you need a serial port. Most computers have them built-in; for others you need to purchase a serial card if you do not already have one available.

Internal modem cards already have the serial port electronics built-in on the card.

### ♦ Verifying the serial port set up in a Windows operating system

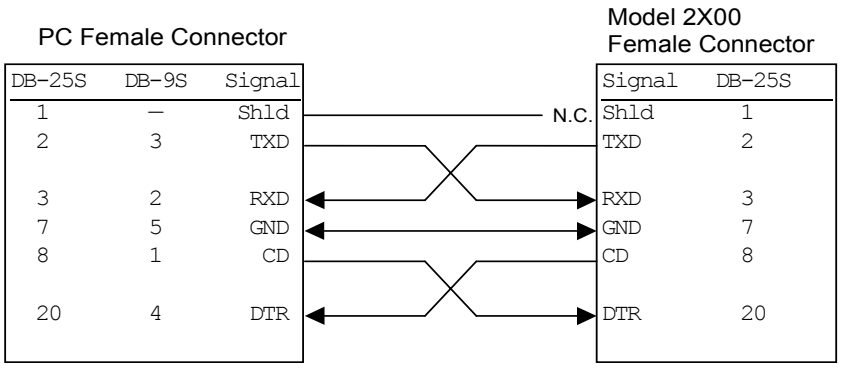
1. Click on the Start button on the Task Bar.
2. Select the Settings option from the Start menu.
3. Select the Control Panel from the pop-up menu.
4. In the Control Panel window, double-click on the System icon.
5. Click on the Hardware tab of the System dialog box.
6. Click on the Device Manager button. (For help on using the Device Manager, click on the Action Menu.)
7. In the list of devices displayed, double-click on the Ports (COM & LPT) selection.
8. Double-click on the Communications Port 1 option to open its dialog box.
9. In the COM1 dialog box, click on the Resources tab to display the port's address and IRQ settings.
10. Repeats steps 7 through 9 for COM2 to obtain its settings.

## Paging Terminal Local Connect Option

Check out the PC serial port setup as outlined in the preceding topic.

If you have purchased the Local connect option, you should have received a cable with your terminal. To prevent problems due to cabling, use this tested cable - *DO NOT* use other cables. (Once you have it running reliably, then you can change or extend it as needed.) For your information, the cable is shown in Figure 47.

*Figure 47: Local Connection Option Serial Cable*




(The Shield on pin 1 is optional; if used, it should be connected only on one end of the cable, to prevent ground loops; however, it usually does not cause problems if both ends are connected).

If any of these lines are missing, ZlinkW probably will not work.

## Modem Connect

### Modem Connect - Internal

Some modems are set with software commands instead of the hardware switches or jumpers shown below. For these modems, you need to obtain the correct setup codes from the modem manual, corresponding to the settings noted below. Then the proper codes are put into an initialization file in the Zetron directory called modem.ini. When ZlinkW starts up, it looks for this file, and if found, sends its contents to the modem. See *Modem Setup - Software* on page 190 for details. (Applies to version 300 software).

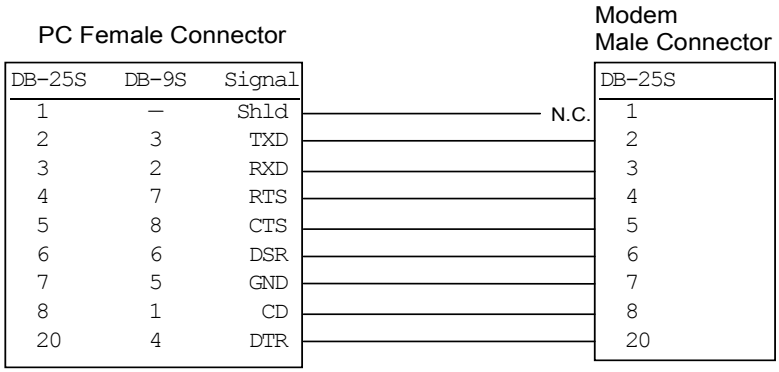
If you have purchased a modem in a market outside the U.S., be sure it uses Bell, not CCITT, 1200 baud standards as default. If it defaults to CCITT and you cannot change it with a switch or jumper, you will need to use an initialization file, or a Hayes command along with the telephone number, to put it into Bell standard.

Zetron supports the Hayes Smartmodem 1200B and compatible modem cards. Zetron does not support using modems that conform to the “WinModem” standard. These modems use internal software to accomplish tasks that used be done by hardware units called UARTs. This can create memory address problems that ZbaseW cannot deal with. The simplest solution is to use a modem model that still has UARTs.

### Modem Connect - External

The cable between the modem and computer should simply bring all the wires directly through. Some cables might bring only a few lines through, causing problems. We require only the wires shown in Figure 48.

*Figure 48: External Modem Cable*




(The Shield on pin 1 is optional; if used, it should be connected only on one end of the cable, to prevent ground loops; however, it usually does not cause problems if both ends are connected).

If any of these lines are missing, ZlinkW probably will not work.

Zetron supports the Hayes Smartmodem 1200 and compatible modems. Zetron does not support using modems that conform to the "WinModem" standard. These modems use internal software to accomplish tasks that used be done by hardware units called UARTs. This can create memory address problems that ZbaseW cannot deal with. The simplest solution is to use a modem model that still has UARTs.

## Modem Setup - Software

Unlike early modems, currently produced modems (that is, 2400 baud and faster) are configured by software commands instead of switches or jumpers.

We provide a way to send a list of commands to the modem each time you start up the ZlinkW software. ZlinkW checks to see if a file named `modem.ini` exists, and if it does, it sends the commands in it to the modem before starting up.

If you know what you are doing, it may be possible reconfigure these types of modems so they permanently keep the configuration information. Each modem manufacturer does this differently, so we leave this method up to you. If you have configured the modem so that its configuration parameters are not volatile, the `modem.ini` file is not necessary. In many cases, it is actually easier to configure the `modem.ini` file.

One question in the installation process asks whether you have a 2400 baud modem and want it initialized each time you call. If you say yes, it makes a `modem.ini` file which contains commands that work for most 2400 baud modems. This command string is currently:

```
AT&C1&D3X0/V1Q0/E1
```

- or you might try -

`AT&M0&KO&IO&H0`
(works for most U.S. Robotics modems)

If it is not working for you, you can edit the `modem.ini` file as needed. Table 22 contains reference information on these commands. The "AT" at the beginning gets the modem's "ATtention", then commands follow in uppercase with no spaces between them. Look in your modem user manual for more information.

*Table 22: Modem Initialization Commands*

| Command | Effect |
|---|---|
| &C1 | CD (Carrier Detect) active, not fixed or ignored. |
| &D3 | DTR response is to hang up and reset the modem. |
| X0 | Say CONNECT instead of CONNECT 1200. |
| V1 | Return Verbose messages (words), not number codes. |
| Q0 | Result codes enabled |
| E1 | Command echoing enabled. |

# Connections

## Local Connect

If you have the local connect option, connect one end of our cable to the serial port of your PC. Connect the other end to the serial connector in the terminal.

## Phone Line Connect

Be sure that you have the PC modem connected to one (outgoing) phone line, and the terminal connected to a separate (incoming) phone line: the modem in the Model 2100/2200 must see ringing to answer.

In other words, you cannot just hook the modems directly together. If you happen to have a telephone tester or telephone line simulator that can provide ringing, you can use it instead of going through the central office.

Be sure you are plugged into the **LINE** jack of the modem card in slot 2 or 3 of the paging terminal, *not* the **PHONE** jack. We usually cover up the **PHONE** jack with a label to help prevent this problem.

On the modem for your PC, similarly check that you are using the **LINE** jack, and not the **PHONE** jack.

## ZbaseW Setup

The “setup” procedure to support communications between PC running ZbaseW and ZlinkW and the paging terminal consists of starting ZbaseW and filling in the necessary information on the **Locations** form. This form holds the information necessary for ZbaseW to use ZlinkW to contact the paging terminal.

♦ **Filling out the Locations form:**

1. Start the ZbaseW program.
2. Select the **Edit** tab and click on the **Locations** button.
3. Click on the **New** button.
4. In the **Site Name** field, enter the name used to identify this paging terminal and/or site.
5. In the **Password** field, enter the password used (if any) to gain access to the paging terminal. This field may be left blank.
6. In the **Phone** field, enter the telephone number used to call the modem attached to the paging terminal service port. If the PC is connected to the paging terminal service port by means of an Ethernet network, use the **Phone** field to enter the IP address assigned to the paging terminal followed by its 4-digit port number. In the case of a direct serial port connection, this field may be left blank.
7. In the **Port** field, enter the port number of the PC serial port (COM port) used to communicate with the paging terminal either by modem or directly. If the PC is communicating with the paging terminal over an Ethernet network, this field is left blank.

## Running ZlinkW

Most of the tasks you will need to accomplish in maintaining the paging terminal can be taken care of from with in ZbaseW. When working from within that program, ZbaseW will take care of starting and controlling the ZlinkW program. There are however, a number of commands that can be used directly with ZlinkW in command-line fashion. You will need to access ZlinkW directly in order to use these commands.

One way to access ZlinkW manually is to locate it on the PC Start menu and click on it. Manual access to ZlinkW may also be achieved from within ZbaseW.

**Note** For a detailed description of the commands available in ZlinkW, see *ZlinkW Command Reference* on page 314.

♦ **Accessing ZlinkW from within ZbaseW:**

1. Start the ZbaseW program.
2. Select the **Comm** tab and click on the **ZlinkW** button.
3. Wait while ZbaseW starts ZlinkW and contacts the paging terminal.
4. Enter manual ZlinkW commands at the command line prompt to accomplish your task.
5. When finished with the ZlinkW, wait until the paging terminal is idle and click on the **Disconnect** button in the ZlinkW menu bar.

# Troubleshooting

Items covered in the previous sections will prevent most problems. Here are a few more suggestions.

## Garbage on Screen

Unusual and special characters on the screen is a common problem. If ZlinkW seems to hook up, but you get noting but arrows, brackets, numbers, and other junk on your screen when it connects, then the `ansi.sys` driver is not properly installed on your machine. This happens when the installation process was not followed or is not effective on your computer.

Basically, the `config.sys` file on your boot disk needs to have the line `DEVICE=ANSI.SYS` in it, and the `ansi.sys` driver needs to be present on the boot disk.

Fix by installing ZbaseW correctly, or call Zetron.

## Check Terminal Modem

You can verify that the modem in the terminal is at least answering. With an ordinary telephone (on its own telephone line), call the telephone number that is hooked to the terminal. You should hear it ring 1, 2, or 3 times. Then the modem in the terminal will answer. You should then hear its modem tone, both in your ear piece and from the modem speaker. If you speak loudly, you can hear your (distorted) voice over the modem speaker.

## Check PC Modem

On the other side, you can verify that the modem in the PC is actually dialing the terminal. Temporarily unplug the line from the terminal modem and plug it right into an ordinary telephone. Call the terminal telephone # using ZlinkW. You should hear the telephone ring. If you pick up the telephone, you should just hear silence. After testing this, be sure to plug the telephone line back into the correct jack on the terminal modem!

## Other Checks

If you are not making connection, and you have some kind of switch on the telephone line to the terminal, for instance to switch between a desk telephone and the terminal, make sure it is in the correct position.

Also, make sure there are not other devices on the line, for example FAX machines, other modems, computers, terminals, desk phones someone might pick up when they hear it ringing, etc.

If you are not sure where the problem lies, let us call the terminal with our modem. If we can connect to it successfully, this will at least tell us that the problem is not in the terminal.

## Machine/Environment

PC-compatible computers, peripherals, and environments can vary widely. Incompatibilities can affect everything from not being able to link up at all, to occasional intermittent problems. You should review these items:

### Hardware

- CPU SPEED
  We have encountered a few problems with machines running at their higher speed clock rates.
- BOARDS
  Plug-in boards, such as multi-function or expansion boards, can cause problems with conflicting interrupts or addresses. For instance, there may be a hidden COM port on a board. Check all of your documentation for each board - if it mentions COM ports, find out how to disable any you are not using.

  There has been a case where a real-time clock board was causing a problem because of an interrupt conflict.
- DISPLAY
  Occasional problems have occurred with certain video display cards. If there is anything unusual about your display, try a standard display mode and monitor for testing.
- UPDATES
  Check with modem manufacturer and computer manufacturer - are there any software/firmware/hardware updates to the equipment? In one case, the customer needed a newer driver for his modem.
- CONNECTORS/SOCKETS
  Try unplugging and plugging the card, re-seating other cards in the PC, and trying different slots. This should fix any problem due to poor connections.

### Software

- MS-DOS
  ZlinkW is intended to run under MS-DOS or PC-DOS, version 2.x or 3.x. ZlinkW may not work under multi-tasking environments, or on network systems, or on operating system work-a-likes.
- TSRs
  TSR (memory-resident or background) utility programs may cause a problem in some cases. A TSR that tried to use the same COM port as ZlinkW while linked up to the terminal would definitely cause a problem. Conflicts might arise if TSRs use too much memory for ZbaseW to run. A TSR may steal too much time during interrupt handling, causing ZlinkW to fail or be unreliable. In one case, a resident terminal communications program was causing the problem by taking over the COM port.

  For testing purposes, remove all TSR programs.
- ZETRON VERSIONS
  The ZlinkW version must correspond to the ZbaseW and ZPAGE version. Incompatibilities might cause wrong Local Connect baud rate (4800 vs. 1200), incorrect password system handling (version 300 vs. earlier versions), etc. When calling, tell Zetron what version of ZlinkW you have. Just type:

  ```
  ZlinkW
  ```

  at the DOS prompt in your Zetron directory to find out what version it is. Your ZbaseW version is listed at the top of the screen in the Main Menu.
- ANSI.SYS
  If the computer locks up or goes crazy when you try to run ZlinkW, try using a different ansi.sys file.

### Try A Different Machine

As you can see in the above section, there are many possible ways for failures to occur due to the hardware/software. If you have another computer system (and/or modem & cables) available, try it.

### Specific Problems

#### Connects, then drops Link Connection

If you are using an external modem, its switches are OK, and it even works with other software - probably the cable is not passing all the pins through, especially pins 8 & 20.

Another possibility is other modem devices on the same telephone line. A FAX, or a modem in a PC, will usually answer before the modem in the paging terminal, and will sound the same or similar, so make sure no such devices are on the same telephone line.

Alternatively, if you have the Local Connect option, if someone is already using it (connected & talking to the terminal via serial port) and you try to call by modem, it will answer and disconnect.

### Random Link Failures

- Interruptions (modem link) - do you have call waiting, call forwarding, PBX interrupt beep, or ANY condition that can break in on a call?
- Ground loops (Local link) - the shield wire should be connected only at one end of the cable.
- Noise - any high power equipment nearby or on same power lines? E.g., elevator control equipment, arc welder, power tools. Local link is especially susceptible - is local serial cable running right next to a source of noise like this?
- RF - is there a lot of stray RF floating around? Usually this will cause other intermittent problems with the terminal in addition to link problems.

### Office Machine Modem will not drop Phone Line

Check that modem's DTR state is active. See above for Hayes 1200 modem settings. Other modems may use switches, jumpers, or software commands to control the DTR response. The modem's response to the DTR signal dropping should be “hang up and go to command state”.

### External Modems

Check modem manual for RS-232 connector pinout. Make sure all signals are present, especially CD, DTR, RTS, and CTS.

# Voice Storage System

This section describes the voice storage system used in the paging terminal. It describes the operation of the voice system, how to install the voice card, how to set the mode switches on the card, how to use the test pins to troubleshoot the voice card, and how to upgrade the software on the card.

## Overview

For systems requiring voice storage capacity (such as for PageSaver™), the Adaptive Differential (ADPCM) Voice Storage option (950-9061) can be installed. With ADPCM, voice audio can be stored with almost no perceptible degradation in audio quality.

Multiple channels can record or play simultaneously, even playing the same single message in parallel. Imagine the worst scenario that a paging terminal has to deal with several telephones all ringing at once. Now watch how the Model 2100 or 2200 with the Voice Card is able to handle it: as the trunks are answered, the Voice Card begins playing the “Welcome” message; each caller hears it at the same time. Halfway through, another telephone begins ringing. This does not present a problem. The Voice Card begins playing on another channel and that caller, too, gets the complete “Welcome” message (no caller has to wait for the message to wrap around to the beginning because each caller gets a dedicated playback channel). As each message completes, the Voice Card switches modes and begins recording the callers. With the messages complete and safely stored on disk, the terminal hangs up, answers other calls, and repeats the cycle while the recorded messages are replayed for broadcast through the Station card.

For the storage medium, the Voice System on a Model 2200 uses a long-life hard disk. Not only does this provide non-volatile storage for voice messages, but it also means that they can be written as files of virtually any size up to capacity of the hard disk. No extra space is wasted for short messages because the file is only as large as necessary.

An additional feature stretches hard disk and paging channel economy by shrinking message length. The Pause Compression feature makes this possible by removing

excessive silent gaps between words during the recording, thereby saving both voice storage and disk traffic.

The Voice system does not trade capacity for message quality. Its bandwidth capability exceeds that of standard telephone lines, ensuring that the playback fidelity will be just as good as the original message. Even when recording with the Pause Compression feature turned on, audio is clean and the silent gaps are not missed.

# ITU ADPCM Cards (702-0065 and 702-0066)

The ITU ADPCM cards covered in this subsection are available as part of two option packages. There is the “standard” version (950-0385) and the “high capacity” version (9500386). A standard card has 14 voice channels. A high capacity card has 28 channels. A paging terminal can have one or two of the standard capacity cards, or a single high capacity card.

The cards are referred to as “ITU” ADPCM cards to differentiate them from an older version of ADPCM card that was discontinued in 2003.

## Slots

The Voice Card can be plugged into any card slot that has connectors on both the upper and lower backplanes. On the Model 2200, slot 5 or 6 is normally used; on the Model 2100, slot 4 or 5 is normally used.

## Address Settings

The ADPCM card has address jumpers that select the I/O address for the card as shown in the following table (multiple cards share the same memory area).

| Jumper | Meaning |
|---|---|
| JP1 | A = Card #1<br>B = Card #2 |
| JP3 | A = Card #1<br>B = Card #2 |

## Mode Settings (ITU ADPCM Cards 702-0065 and 702-0066)

These configure options for Pause Compression rate and testing modes by using a software file that is loaded at power-on or boot-up. Consult Zetron 2000 Series Applications Engineers for specific information.

### Audio Level

No audio adjustments can or need to be made to the Voice Card. It will record audio at whatever level it goes into the card and replay it at exactly the same level. Still, audio level is a concern if the Pause Compression option is selected. The adjustment is not difficult: just make sure that the Trunk card audio level is not so high that background noise causes the Voice Card to continuously record. The test can be made over a typical phone line - or preferably a noisy one - while watching the channel light on the Voice Card. Reduce the audio level until the light is out or only occasionally flickering when you do not speak and on steadily when you do.

### Test Pins (ADPCM Cards 702-0065 and 702-0066)

Five test pins are located near the bottom of the front edge of the ADPCM Voice Card. The signals available at these points may be of help should a problem develop. These points are labeled as shown in Table 23.

*Table 23: ADPCM Card Test Points*

| Label | Function | Purpose |
|---|---|---|
| 1 | PCM Transmit + Enable | This TTL signal goes low each time the card is selected by the system for reading/writing into the dual ported memory area. |
| 2 | PCM Data | This TTL signal goes low each time the system accesses the voice storage RAM (read or write cycle). |
| 3 | PCM Sync | This TTL level signal provides a synchronization pulse for monitoring the voice program. |
| 4 | PCM Clock | 4.00 MHz clock signal produced by circuit logic. This TTL signal is one-fourth of the 16 MHz crystal with 50% duty cycle. |
| 5 | GND | Signal ground reference for other TEST signals. |

## "Old" ADPCM Card (702-9153)

The ADPCM card described in this subsection was discontinued in 2003. It is covered here in order to support existing paging systems.

### Slots

The Voice Card can be plugged into any card slot that has connectors on both the upper and lower backplanes. On the Model 2200, slot 5 or 6 is normally used; on the Model 2100, slot 4 or 5 is normally used.

## Address Settings

The ADPCM card has address jumpers that select the I/O address for the card as shown in the following table (multiple cards share the same memory area).

| Jumper | Meaning |
|---|---|
| JP1 | A = Card #1<br>B = Card #2 |

## Mode Settings (ADPCM Card 702-9153)

These configure options for Pause Compression rate and testing modes by using a software file that is loaded at power-on or boot-up. Consult Zetron 2000 Series Applications Engineers for specific information.

## Audio Level

No audio adjustments can or need to be made to the Voice Card. It will record audio at whatever level it goes into the card and replay it at exactly the same level. Still, audio level is a concern if the Pause Compression option is selected. The adjustment is not difficult: just make sure that the Trunk card audio level is not so high that background noise causes the Voice Card to continuously record. The test can be made over a typical phone line - or preferably a noisy one - while watching the channel light on the Voice Card. Reduce the audio level until the light is out or only occasionally flickering when you do not speak and on steadily when you do.

## Test Pins (ADPCM Card 702-9153)

Five test pins are located near the bottom of the front edge of the ADPCM Voice Card. The signals available at these points may be of help should a problem develop. These points are labeled as shown in the following table.

| Label | Purpose |
|---|---|
| 4MZ | 4.00 MHz clock signal produced by circuit logic. This TTL signal is one-fourth of the 16 MHz crystal with 50% duty cycle. |
| MEM | This TTL signal goes low each time the system accesses the voice storage RAM (read or write cycle). |
| SYN | This TTL level signal provides a synchronization pulse for monitoring the voice program. |
| SEL | This TTL signal goes low each time the card is selected by the system for reading/writing into the dual ported memory area. |
| GND | Signal ground reference for other TEST signals. |

# Upgrades

Software upgrades to the ADPCM Voice Card (702-9153) are made like other 2000 Series software through the maintenance modem port via telephone calls from Zetron Applications Engineers. Extra voice channels are available in sets of four channels as field upgrade kits. These kits add chips for the new channels and replace certain decoder chips. Refer to the instructions that come with the kits.

## Installing New ICs in the Voice Card

### ♦ Adding upgrade ICs

1. Turn off the power to the paging terminal.
2. Remove the ADPCM card by first removing the screw at the top of the card and then pulling out the latch at the bottom of the card. Carefully work the card lose from the sockets on the backplane of the paging terminal.
3. Place the card on a firm, flat, static-safe surface and install ICs as necessary to match information in Table 24.
4. Carefully inspect your work. The notched end of each IC should match the notched end of its socket. Correctly installed, the pins of each IC will be fully inserted and not bent under the chip or hanging outside the socket.
5. Reinstall the voice card by sliding it into its card guides and pushing straight back. It should plug firmly into two bus sockets, one at top and one at bottom. When properly inserted, the card's front panel is flush with the other circuit cards.
6. Restore power to the system. After approximately 30 seconds, you should see the **PRG** and **MEM** lights come on and remain lit.

*Table 24: Adding Channels to ADPCM Card*

| Channels Added | NEC D77C30C X-Coders | U4 PAL |
|---|---|---|
| 4 | U21 through U24 | 601-0157 |
| 8 | U17 through U24 | 601-0920 |
| 12 | U13 through U24 | 601-0921 |
| 16 | U9 through U24 | 601-0922 |

## Adding Second ADPCM Card

### Requirements

- The second ADPCM card must be revision G or later. If the installation is being made in a T1 system, then both cards must be revision G or later.
- The 2000 Series paging terminal must be running ZPAGE version J or later.
- The dual trunk cards installed must be revision E or later to support 48PCM paths.

### Configuration

Prior to installing the second card in the 2000 Series paging terminal, review the settings shown in Table 25 or Table 26 (whichever applies to your system). Configure the jumpers on the second ADPCM card as necessary and be sure to check the position of the jumpers on the first card at the time of installation.

*Table 25: Settings for Non-T1 Systems & T1 Systems with Framer Card Revision C and Later*

| Card Position | Jumpers | ADPCM Software | Options.cus Programming |
|---|---|---|---|
| ADPCM Card #1<br>Channels 1 through 16 | JP1 = A<br>JP2 = A (1.544 MHz clock)<br>JP3 = A<br>JP4 = A (PCM Hwy 1) | U46 = 601-0152 | TotalPCM 48 |
| ADPCM Card #2<br>Channels 17 through 32 | JP1 = A<br>JP2 = A (1.544 MHz clock)<br>JP3 = A<br>JP4 = B (PCM Hwy 2) | U46 = 601-0702 | TotalPCM 48 |

*Table 26: Settings for T1 Systems with Revision A or B Framer Cards*

| Card Position | Jumpers | ADPCM Software | Options.cus Programming |
|---|---|---|---|
| ADPCM Card #1<br>Channels 1 through 16 | JP1 = A<br>JP2 = B (2.048 MHz clock)<br>JP3 = A<br>JP4 = A (PCM Hwy 1) | U46 = 601-0152 | TotalPCM 64 |
| ADPCM Card #2<br>Channels 17 through 32 | JP1 = A<br>JP2 = B (2.048 MHz clock)<br>JP3 = A<br>JP4 = B (PCM Hwy 2) | U46 = 601-0702 | TotalPCM 64 |

### Programming

Changes will need to be made to the `param.sys` and `options.cus` files for the system.

The `param.sys` file must contain the following line.

```
OD V16CH13.VOX V16CH13.VOX
```

This line loads the needed VOX code onto the first and second ADPCM cards. Please note that if your second ADPCM card has less than 16 channels, the second string must be modified to reflect the actual number of channels installed. For an 8-channel card, the second string would be `V8CH13.VOX`. Call Zetron Technical Support if you are uncertain you have the correct vox code.

The `options.cus` file must be configured to enable the second PCM highway. This is done by setting the `TotalPCM` parameter to the right value (either 48 or 64). The correct value is determined by the revision level of the T1 Framer card (702-9551). See Table 25 or Table 26 to determine the correct setting for your system.

# Operation

The Voice Card is the principal element of a recording system that also includes the hard disk and the paging terminal software. It works like this: when the paging terminal is ready to record audio, it selects a voice card channel and instructs it to start recording. The voice card stores the digital audio in its memory buffers until they become full then quickly transfers them to the hard disk. The message builds on disk, one buffer at a time, until the paging terminal tells the voice recording to stop. At that moment, the recorder marks the end of message and transfers its last buffer to the disk. Since no particular space on the disk is reserved for any channel nor are there pre-partitioned maximum size allotments, no space is wasted.

The playback process is nearly the reverse: once the voice card gets the signal to start playing the message, it rapidly reads the data, buffer by buffer, from the hard disk and plays it at normal speed to the audio highway. As soon as it encounters the end of message marker, it immediately silences the audio highway and ceases disk transfer. It also signals the paging terminal, which can then immediately reassign the channel to handle another call.

Since the Voice Card is entirely under control of the paging terminal software, there are no special instructions or training required to use it. It functions invisibly so that the caller on the phone need not know or worry if they are speaking live on-the-air or being recorded for delayed broadcast. Furthermore, the exceptional quality of the playback audio makes every voice page sound live.

## Power Up

The Voice Card comes to life as soon as it is reset. Reset occurs either when the Model 2100/2200 is first powered on or under control of the paging terminal software. Whenever reset, the Voice Card quickly flashes its lights one by one, then leaves them all off. Reset completed, the card is ready for instructions from the paging terminal software.

If you watch the paging system as it is powered on, you will see the Voice Card reset twice. This is normal. The first reset occurs when power is applied to all the cards. At this point, the paging terminal software is not yet running, so the Voice Card may show some rather random and harmless activity with its lights. The second reset happens after the paging terminal software has started. The Voice Card is intentionally reset so that both the Voice Card and the paging software start out in synchronization.

## Record/Play

The lights on the Voice Card will display different information depending on which option is selected by the Mode Switches (see below). However, the DMA light is always a reliable indicator of record or play activity. Each time it blinks a voice buffer of audio data has transferred either to or from the hard disk. If only one voice channel is active, you will see the DMA light blink at a steady one-second rate as the audio buffers fill and get stored to disk.

## Silence Deletion

**Note** While Silence Deletion is useful for voice paging, it is not normally used for voice messaging.

The Silence Deletion option will reduce the size of typical voice messages by removing the long silent gaps between phrases. When the caller says nothing, nothing is recorded. This not only speeds the playback - important over busy paging channels - but also takes less space on the hard disk, leaving more room for other disk space intensive options such as customer voice prompts.

The decision of whether or not to use Silence Deletion lies with the paging terminal operator. It is easy to enable or disable, requiring only that a software file be changed (you edit the `options.cus` file), and it can even be changed in the middle of a recording. The Voice Card removes the silent gaps so seamlessly that it can be difficult to tell, when listening to the playback, where they went. Some clients will actually find the intelligibility of the replayed messages to be improved because the long, annoying pauses - common from first-time or timid callers - are no longer there. The major reason for using Silence Deletion, however, is the reduction in voice airtime and message storage time. Typical replayed compressed messages are 10% to 50% shorter than the original messages. Finally, it nearly eliminates the annoying wrong number situations that end up as twenty seconds of dead airtime.

Perhaps the only reasons to disable the Silence Deletion feature are:

- your paging system experiences only light traffic and channel air time is not at a premium, or
- the nature of what your system is used for makes you uncomfortable with the idea of any sort of “editing” of the message content

The Silence Deletion feature operates according to three characteristics that can be described as attack, decay, and audio level. The attack is how quickly the Voice Card will respond to a new sound after there has been silence. This period needs to be short enough so that speech is not clipped at the leading edges of syllables, yet long enough that random noise spikes are ignored. The value is fixed at 4.5 milliseconds. The audio level is simply the threshold for determining what is noise and what is silence. It also is a pre-set value on the card. The decay or speed is a rate that determines how long the recording continues after the last sound. The Silence Deletion mode can be enabled at any one of three different speeds. The three settings can be experimented with during installation to suit personal taste.

For more information on setting these two parameters see *Commands Found in OPTIONS.CUS* on page 260.

### Lights

The front LEDs serve several purposes. As mentioned, they show when the card is reset and that the software is functioning normally. In the Silence Deletion mode, they show channel recording activity. In addition, with the Silence Deletion disabled, they can display selected information showing general operation or helpful diagnostics.

## Maintenance

### Voice File Restore and Backup

For 2000 Series paging terminals shipped after the summer 1992, we have included a backup set of voice files on the system. This lets you restore one or all of the system voice prompts if you accidentally record over them. It also lets you save and restore any system voice prompts you have recorded yourself.

The instructions here will also assist you in saving the prompts to your PC if desired, and working with individual prompt or custom prompt files.

If you have trouble, Zetron Support Engineers will assist you with these operations. The following details are somewhat technical and assume you are familiar with DOS and our ZlinkW commands.

On the DOS part of the hard disk in the paging terminal, there are two directories established for backing up voice files:

| | |
|---|---|
| C:\ZVOICE | This is the holding area for the original system voice prompts. Zetron writes default files here during production. |
| C:\VOICE | This is the holding area for any customer re-recorded system voice prompts. It is initially empty. |

Table 27 lists the handy ZlinkW batch files, which are used to save or restore all of the voice files. These ZlinkW batch files are not provided with ZbaseW, rather, they are available on the paging terminal if needed. On older systems, we will need to send you the batch files if you wish to use them.

To use any of these files, you need to copy them on to your PC first. Get into ZlinkW, and at the "+" prompt and type for instance:

```
get  yvget.zb
```

You only need to do the above once for each batch file. Thereafter, to run the batch file, get into ZlinkW and at the "+" prompt, do for instance:

```
batchrun  yvget.zb
```

For each batch file, we also show here an example line (for the welcome prompt) from the file. The files consist of several of these lines, one for each of the different voice files.

Please note that all these work only with the system voice prompts, not the client custom prompts (client greetings) which are discussed later.

Please note that the last three files are included only on systems shipping in February 1993 or later. If you do not have them, we can send them to you.

*Table 27: ZlinkW Batch Files for managing voice prompts*

| Batch File Name | Action |
|---|---|
| svrestr.zb | System Voice Restore. Copies all of the original system voice prompt files from the DOS part of the hard disk (from C:\ZVOICE) to the voice storage system (which may be a different partition on the hard disk, or a separate hard disk, depending on your paging terminal's configuration). Useful if for instance you recorded a Welcome prompt you do not like and want ours back. Typical line: `vput  c:\zvoice\sys_welc  sys_welcome` |
| yvget.zb | Your Voice Get (Save). If you have recorded some of your own system voice prompts, and wish to save them, use this. You can do this anytime you change any of your system voice prompts. It copies the system voice prompt files from the voice storage system to the DOS part of the hard disk (to C:\VOICE). Typical line: `vget  sys_welcome  c:\voice\sys_welc` |
| yvrestr.zb | Your Voice Restore. Restores your customized system voice prompts, previously saved using the `yvget.zb` batch file. It copies them from the DOS part of the hard disk (from C:\VOICE) to the voice storage system. Typical line: `vput  c:\voice\sys_welc  sys_welcome` |
| svtopc.zb | System Voice to your PC. * ** Copies the original factory system voice prompts to your PC. Useful for safekeeping, in case the paging terminal hard disk goes bad or is swapped out. Copies files from C:\ZVOICE on the paging terminal's DOS hard disk to the current (ZbaseW) directory on your PC. Typical line: `get  c:\zvoice\sys_welc  sys_welc` |

| Batch File Name | Action |
|---|---|
| yvtopc.zb | Your Voice to your PC. * ** Copies your customized system voice files to your PC. You must first have previously saved the prompts using "yvget.zb" above. Useful for safekeeping, in case the paging terminal hard disk goes bad or is swapped out. Copies files from C:\VOICE on the paging terminal's DOS hard disk to the current (ZbaseW) directory on your PC. Typical line:<br>`get  c:\voice\sys_welc  sys_welc` |
| pctoyv.zb | Your PC to Your Voice. *<br>Copies your customized system voice files, previously retrieved to your PC with `yvtopc.zb`, to C:\VOICE on the paging terminal's DOS hard disk. Note that you would first run this, then run "yvrestr.zb", to make the prompts active in your voice storage. Typical line:<br>`put  sys_welc  c:\voice\sys_welc` |
| alt_put.zb | Put Alternate Prompts ***<br>Puts Zetron System Alternate prompts (*.now files) from C:\ZVOICE to the voice partition, replacing normal set. This is for DTMF over prompts, mostly used for Notify Voice or Display operation. It switches the following voice files to the alternate factory set that basically say "now" in place of "at the tone": sys_dmsg, fcode_input, sys_end_end, security_code, passcode_input, activity_input, security_input, ptype_input, greeting_input. |
| alt_undo.zb | Undo Alternate Prompts ***<br>Puts Zetron System normal prompts from C:\ZVOICE to the voice partition, restoring the originals (undoing what alt_put.zb did). |

[1] Note that these transfer files between your PC and the paging terminal. There is a total of about one megabyte of system voice files. It can take quite a while to transfer all these, especially if you use ZlinkW via modem instead of direct:

at 1200 baud (modem ZlinkW): about 2.4 hours

at 4800 baud (direct ZlinkW): about 37 minutes

[2] On the paging terminal, there are separate directories for the original system voice prompts vs. any customized system voice prompts. These batch files copy either set of prompts to the current directory on your PC. This means that if you run "svtopc.zb", then run "yvtopc.zb", you will have only the results of "yvtopc.zb", since it will have overwritten the voice files of the same name that "svtopc.zb" grabbed. If desired, you could alter these batch files to write to different directories on your PC.

[3] Note that these are for the Zetron prompts. If you record your own, you should not run any alt*.zb file again. Instead, use the normal yv*.zb files to save/restore/transfer your whole set of files.

## Single Files

The batch files in Table 27 work with all of the voice files. Many times, you will only need to work with one or two. The following instructions explain to do that.

**Note** Voice file names are case sensitive - "p1234567" is different from "P1234567". DOS file names are not case sensitive. In the examples that follow, paths are not shown; you can always specify a path, if desired, when specifying DOS filenames. (There is no path for voice files).

To save any individual voice prompt from the voice storage system to the DOS part of the paging terminal's hard disk, the general format is:

```
vget  voice_file_name  dos_file_name
```

To put it back, do:

```
vput  dos_file_name  voice_file_name
```

Please note that the voice file names are sometimes longer than the name-length DOS supports. Therefore, you will have to shorten or rename some files. For instance:

```
 vget  sys_welcome  sys_welc
```

Please note that `vget` and `vput` simply transfer between different areas on the paging terminal hard disk(s) (between voice storage and DOS storage). They do not transfer to or from your PC.

To transfer a file to your PC, you must first do a `vget` as described previously, to get it from the voice storage system to the DOS part of the hard disk on the paging terminal. Then, you use the normal "get" command to get it to your PC, for example:

```
get  sys_welc
```

To put a file back from your PC, you use the standard "put" command:

```
put  sys_welc
```

This puts it to DOS on the paging terminal. Then, to make it the active prompt, you must use `vput` as described previously, to get it from the DOS part of the hard disk to the voice storage system:

```
vput  sys_welc  sys_welcome
```

## Client Prompts

If you want to save a customer's custom client prompts, the format of the filename is:

```
x#######
```

Where `#######` is their 7-digit subscriber ID in the database (with leading zeros if necessary, for example the number 1234 is 0001234; no dash is allowed), and "`x`" is "`p`" for the Paging/Insure mode prompt, "`s`" (stands for "saver") for the Mailbox/Notify prompt, and "`a`" for the Announce mode prompt. Note that "`x`" is always a lower case letter.

So for instance, to save the Paging and Notify prompts for subscriber 555-1212, type in ZlinkW:

```
vget  p5551212  p5551212
vget  s5551212  s5551212
```

Then to get to your PC:

```
get  p5551212
get  s5551212
```

If later on, the customer destroys their Paging mode prompt (deletes it, or re-recorded it and can't record one as good), you would first do:

```
put  p5551212
```

to put it to the DOS disk on the terminal, then:

```
vput  p5551212  p5551212
```

to transfer it to the voice storage system.

Be careful if doing custom prompts - if you do lots of them, you could consume enough DOS storage to cause paging terminal trouble. Check remaining disk space with the "`df`" command - there should be at least one megabyte free for normal paging operations. If you are transferring the files to your PC, you can delete them from the DOS disk on the paging terminal via the "`del`" command, for example:

```
del  p5551212
```

Doing so for each file transferred to your PC will avoid the problem of filling up the paging terminal disk.

## Mirrored Drive Syncronizing (Obsolete)

If you have purchased the Mirrored Voice System option, your system has two disk drives. The system software keeps the voice system synchronized between the two drives - every time a voice file is written to one drive, it is also written to the other one.

However, the mirroring does not affect files on the DOS part of the hard disks, such as the paging software, the subscriber database, log files, and so forth.

To keep the DOS part of your mirrored drive up to date, you should periodically run the batch file we provide for this purpose. If you have not already got it on your PC, get into ZlinkW and type at the "+" prompt:

```
get dmirror.zb
```

Then, any time you want to make the mirrored drive the same as the main drive, get into ZlinkW and type at the "+" prompt:

```
batchrun dmirror.zb
```

This will copy all of the operating files, and owners files (PageSaver customer tracking files), from the main drive to the mirrored drive.

You might want to do this once a week, or once a month, or whenever you add or change cards in your system. Then, if the main drive fails completely, you can reconfigure the mirrored drive and put it in as the main drive. This way, your database will be mostly up to date (giving you more time to do the Full Rebuild process to bring it current), and your configuration files should be correct.

# RAID Hard Drive

The RAID hard drive option was introduced in 2004 and replaces the Mirrored Drive option. The RAID hard drive consists of two high performance IDE drives housed in a special chassis that controls the drives and automatically keeps them synchronized. Both drives contain identical data and either one may serve as backup to the other. The RAID chassis presents a standard SCSI interface to the CPU and thus requires no operating system or paging software changes. All intelligence required to manage the process is contained in the RAID chassis. The RAID drive solution is superior to the old Mirrored Drive option because all system files are backed up, not just the voice files, plus a backup drive can be removed and replaced with power on. This allows the system operator to take a system snapshot at any time and remove the drive for off-site storage. The RAID controller firmware continually monitors each drive's operation and if it senses that a drive has failed or is failing, all accesses are directed to the working drive and the unit will sound an audible alarm. Note that the RAID hard drive option is for the M2200 only and is not offered for M2100 terminals because of limited space to mount the drive.

If you purchased your system with the RAID option installed, the drives are installed, the software is loaded and all files are synchronized. If you have purchased the RAID drive option as an upgrade and are installing it yourself, the following documents should have come with the hardware components. Follow the instructions in the documentation carefully.

| | |
|---|---|
| 011-0662 | Installation Instructions for M2200 RAID Drive Option |
| 011-0664 | Transferring Files From Old SCSI to RAID Drive |
| 011-0665 | M2200 RAID Drive Duplication Procedure |

The following sections contain instructions for installing and working with the RAID drive components and for transferring data from the old SCSI drive to the RAID drive. Please read them for an understanding of how the RAID system operates and how to duplicate drives and work with the files.

## RAID Drive Option Installation (011-0662)

TOOLS: #1 Phillips screwdriver, Office PC with ZbaseW.

### ♦ Installing the RAID drive

1. The RAID hard drive hardware consists of two removable 2.5 inch IDE hard drives, a RAID controller chassis that fits into a 3.5 inch hard drive bay and a cable adapter.
2. If you have a Pentium CPU and your disk drive is mounted in the drive bay below the backplane, remove the SCSI drive and mounts by removing the two front screws and loosening the two rear screws. If you are upgrading from a Zetron Hard Card perform steps 3 - 4 to install the disk mounts and cabling otherwise skip to step 5.

3. There are two threaded holes in the rear sheet metal panel of the M2200 chassis on the left side under the card slots about 1.5 inches above the EMI shelf. One is located below card slot 1 and the other is located below card slot 10. Start a screw in each hole but do not tighten at this time.
4. Install the Disk Power Cable (709-7048) into the Molex connector located at the left rear corner the EMI shelf.
5. There are six pre-drilled holes in the drive mounts to mount 2 hard drives one above the other. Mount the RAID drive using the lower set of holes. Two or three of the holes will align with the side mounting holes in the drive frame. Only two screws are needed in each side of the drive.
6. Attach the front disk mount (415-9716) to the side of the drive nearest the 4-pin power connector. Orient the bend toward the circuit board side of the drive and the free edge away from the drive body.
7. Place the slotted holes in the rear drive mount over the screws previously installed into the chassis. It will drop down into position. Install screws through the two holes in the front disk mount, which should now be aligned with two threaded holes in the EMI shelf. Tighten all screws firmly.
8. Connect the 4-pin power pigtail from the chassis to the power connector on the RAID cage.
9. If you have a Zetron CPU and are not upgrading your CPU, remove the Hard Card from the chassis and carefully remove the disk drive and controller from the sheet metal. The old ribbon cable and sheet metal can be discarded. Note the position of pin 1 on the SCSI connector and reinstall the SCSI controller card in it's original slot.
10. Connect the long end of the 50 pin ribbon cable to the to the SCSI connector on the Pentium CPU, or controller card. The end with two connectors goes to the disk drives.
11. Route the ribbon cable between the CPU and the adjacent card to its right, down into the space below the peripheral cards. If you have a Pentium CPU take care that the cable properly clears the fan. Plug the connector on the free end into the 50-pin side of the SCSI adapter.
12. Insert the cable with SCSI adapter onto the 68-pin RAID cage connector. Note that the SCSI cable adapter is offset and will only fit one way.
13. Insert a previously loaded system hard drive into one of the hard drive slots in the RAID cage and power up the terminal.

## IDE Hard Drive Installation Instructions (011-0663)

### ♦ Installing the IDE drive

1. The hard drive is intended to be installed into one of the two drive bays in the RAID controller chassis. There is no difference between the bays and the following steps apply to either bay.
2. Once the 2.5 inch IDE hard drives are installed into their drive trays, they become a hot swappable RAID controller sub-assembly, meaning that no physical damage to the drive or controller will result when drives are inserted or removed. This does not mean that data will never be corrupted. If the drive is being accessed when it is removed from the raid controller chassis, data corruption may result. Always verify that the yellow access led is off before removing any hard drive from the raid cage. This is especially important if you are removing a drive for backup purposes. Shutting down the system and turning off power before removing the hard drives is always the safest practice.
3. While observing static handling procedures, carefully remove the hard drive from its packaging and verify that it is securely mounted in its drive tray. You may need a small Phillips screwdriver. A new unformatted drive may safely be installed into the raid chassis with power on since the raid controller will not access it until the drive is ready.
4. Insert the new drive into the raid controller chassis. As soon as the controller detects the new hardware, it will automatically begin to copy data onto it.

## Transferring Files from Old SCSI Drive to RAID Drive (011-0664)

The next three subtopics describe how to transfer the operating system, paging application software and voice prompts from the standard SCSI drive to the RAID drive.

### ♦ Assigning SCSI drive as drive D:

1. Set drive ID on old SCSI to ID #1.
2. Remove termination on old SCSI drive.
3. Power down system and install old SCSI drive above the raid drive using the top holes of the drive brackets. Make sure the drive connectors are to the left.
4. Connect center SCSI cable connector to old SCSI drive with the stripped edge toward the power connector.
5. Connect the 4-pin power pigtail from the chassis to the power connector on the old SCSI drive.
6. Power up the M2200.

### ♦ Coping system files from SCSI drive (D:) to RAID array (C:)

1. Go to the office PC and start ZbaseW. Select COMM/ZlinkW. At the "+" prompt type, "`LS<space>d:\zdir`" and verify that it lists the system configuration files, log files etc. If it simply returns you to the "+" prompt then the old drive was not recognized, recheck drive ID, terminator and cabling.

2. To copy files from old SCSI type, "`copy d:\zdir\<filename> c:\zdir`".
3. The following files should be copied:

   Oparam.cds
   Options.cus
   Trunks.cus
   Network.cus (may not be present)
   Events.cus (may not be present)
   Messages (may not be present)
   Group.bin (may not be present)
   Sdb.ptr
   Subs2000.??? (to determine this filename type, "`sdb`" at the "+" prompt)

## Transferring Your Custom Voice Greetings

Accomplishing this task will require that you first re-label the drives and then copy the files from the old drive to the new RAID array. Once you are finished with that you will remove the old drive and assign the RAID array to be drive C: in the system.

### ♦ Labeling drives - SCSI = C: and RAID = D:

1. Power down system.
2. If not already done, install the old SCSI drive per above.
3. Set switch D1 on front of RAID cage to the down position.
4. Power up system.

### ♦ Copying files from SCSI Drive (C:) to RAID Array(D:)

1. In ZbaseW select COMM/ZlinkW.
2. At + prompt type, "md d:\v".
3. For each file you need to copy type,
   "`Vget <filename> c:\v\<filename>`"
   Example: `vget p5551212 d:\v\p5551212`

**Note** If you have a VGET batch file type, "batchrun vget.bat" to copy all files. (See *Creating Batch Files for Transferring Custom Greeting Voice Prompts* on page 214.)

**Note** Custom greeting filenames will be in one of the following formats:
s5551212 = Mailbox/Notify mode greeting
p5551212 = Paging/Insure mode greeting
a5551212 = Announcement mode greeting

♦ **Copying voice files into voice partition on RAID drive**

1. Once all files are copied power system down and remove old SCSI drive. Set D1 on front of RAID drive to the UP position.
2. Power system up.
3. Run COMM/ZlinkW again and for each file you need to copy type in:
   "`VPUT c:\v\p<filename>  <filename>`"
   Example: `VPUT c:\v\p5551212  p5551212`

**Note** If you have a VPUT batch file type, "`batchrun vput.bat`" to copy all files. (See *Creating Batch Files for Transferring Custom Greeting Voice Prompts* on page 214)

## Creating Batch Files for Transferring Custom Greeting Voice Prompts

♦ **Batch file procedure**

1. Create a text file containing a list of the voice prompt files. From the Office PC, at the + prompt type the following:

   ```
   "Logopen vls.lst"
   "Vls *"
   "Logclose"
   ```

   Press ESC to exit ZbaseW.

   You now have a text file that names all of the voice files for the system. This file is called "`vls.lst`" and should be in the c:\zetron folder.
2. Creating a VGET batch file.
   a. Start the NotePad (or WordPad) text editor, go to the c:\zetron folder and open the file named "`vls.lst`".
   b. Use the Save As command in NotePad to save a copy of the file under the new name "`vget.bat`".
   c. From NotePad, open the "vget.bat" file. Format each line of the file as follows:
      `VGET <filename> d:\v\<filename`
   d. Save and exit

   Return to step 7 in the voice file transfer procedure.
3. Creating the VPUT batch file.
   a. Start the NotePad (or WordPad) text editor, go to the `c:\zetron` folder and open the file named "`vls.lst`".
   b. Use the Save As command in NotePad to save a copy of the file under the new name "`vput.bat`".

c. From NotePad, open the "`vput.bat`" file. Format each line of the file as follows:

```
VPUT <filename> c:\v\<filename>
```

d. Save and exit.

Return to the final step of *Copying voice files into voice partition on RAID drive* on page 214.

## IDE Disk Drive Duplicate Procedure (011-0665)

### ♦ Duplication procedure

1. Boot the paging terminal with one drive in the RAID controller chassis. Either drive may serve as the source drive. Please note that if you put in two drives that are not synchronized into the RAID controller, no copying will occur. This is because the controller does not know which drive to use as the source drive.
2. With one drive removed the rectangular status LED corresponding to the drive will be yellow and the RAID controller will beep once if drive #1 is removed and twice drive #2 is removed. This is normal as the controller thinks that the removed drive is a bad drive.
3. Install the target hard drive to into the open bay in the RAID chassis. After a few seconds the RAID controller will recognize the new hardware and the rectangular LED corresponding to that drive should turn green, indicating that the drive is good.
4. The RAID controller will recognize that the new drive is not in sync with the source and start to copy data to it. The round yellow LED to the left of the status LEDs should start blinking to indicate that the drive is being accessed.
5. The RAID controller will duplicate a hard drive in about five minutes. When it is done the yellow access LED will stop blinking and the rectangular status LED for the target drive will go out indicating that the drives are synchronized.

# System Configuration Files

## Overview

This section describes the `config.cds`, `oparam.cds`, `options.cus`, and `trunks.cus` files. These files contain information about your system that is used by the microprocessor and its software to control your paging terminal. While these files are created at the factory to suit your particular needs, they are described in this section in the event you wish to change the configuration of your system. To determine just what aspects of paging terminal operation these files control read the entire section and examine a copy of your `oparam.cds`, `options.cus`, or `trunks.cus` file using a text editor, such as Notepad.

> **Caution!** Change system configuration files, especially `config.cds` or `oparam.cds`, at your own risk! You can easily cripple paging operation if you do something wrong. If you want to change something, please let us assist you.

> **Note** Always save a copy of the configuration files that you get from the Paging Terminal. Then you may be able to restore your system to its prior condition if everything "goes crazy" after you reboot.

The following procedure is provided as an example of how one of the configuration files is obtained from the paging terminal, modified, and then returned to the paging terminal. (The `oparam.cds` file is used in this example.)

### ♦ Editing a system configuration file

1. Obtain the file from the Terminal by choosing **ZlinkW** from the ZbaseW Communications menu. Type the following command at the "+" prompt:
   ```
   + get oparam.cds
   ```
2. Press **ESC** to exit ZlinkW. Then exit ZbaseW.
3. Use your own text editor on your office computer to edit the file. Make sure your editor can edit and save plain ASCII files. Word processors may add control

characters that cause problems. If you make changes to the file, please put a note in the history section at the top of the file describing what you did.

4. Transfer the new file back to the Terminal by getting back into ZbaseW and accessing ZlinkW again. Type the following command at the "+" prompt:
   ```
   + put oparam.cds
   ```
5. To make the Terminal use the new parameter file, issue the reboot command at the "+" prompt:
   ```
   + reboot
   ```

In all system configuration files, anything following a semicolon (";") is a comment.

## CONFIG.CDS File

The ASCII text file named `config.cds` loads the peripheral cards. The system reads this file during startup. It tells the system what Trunk, Multiport, and Station cards should be found at which addresses, and what software to load into each card.

This file is usually changed only when adding cards to the system, or, if special or updated software is needed for existing cards.

Zetron usually changes this file for you.

The file format is simple. There is one line for each peripheral card. The card address is presented first. The address listed in the file must match the actual address set by the switches on the upper front of the card; usually, the address number is the same as the slot number. Unlike most numbers in these configuration files, this address/slot number is specified in decimal. Following the address is the ROM version of the card, which identifies the card type and rarely changes for a given type of card. Finally, the software image file that is to be loaded into the card is listed. In addition, comments are usually present. A comment is any text that follows a semicolon.

Following are some typical lines found in a `config.cds` file:

```
;                    Trunks
7 4 trunk4k.img               ; card  7, single trunk revision 4k
8 8 2ser8a6.img               ; card  8, multiport rev. 8a6
9 6 2trni6e5.img              ; card  9, dual trunk rev. 6e5
;                    Stations
15 7 xmtr7d6.img               ; card 15, old station revision 7d6
16 1 2000v1a4.img              ; card 16, new station revision 1a4
```

## OPARAM.CDS File

The ASCII text file named `oparam.cds` provides a method for changing programmable parameters in the Trunk and Station cards. The file resides in the Paging Terminal as a

script file stored on the hard disk. When the paging program starts up and initializes all of the Trunk and Station cards, it reads the script file - named `oparam.cds` - and transfers the information there to the cards. All of the programmable features have default values that have been chosen to work in most typical installations.

## File Format for OPARAM.CDS

The script file is line-oriented: one programmable feature per line of the file. The line contains the card address and unit number, an argument count, a parameter code, and the parameters themselves. Each line is terminated by a carriage return. All numbers in the script file are entered as 2-digit, hexadecimal values. For example, the number three is entered as "03" and the number thirty-one is entered as "1F". Refer to *Appendix C: Decimal to HEX Conversion* on page 369 for decimal to hex conversion. Numbers are separated by one or more spaces or tabs.

Each line looks like the following:

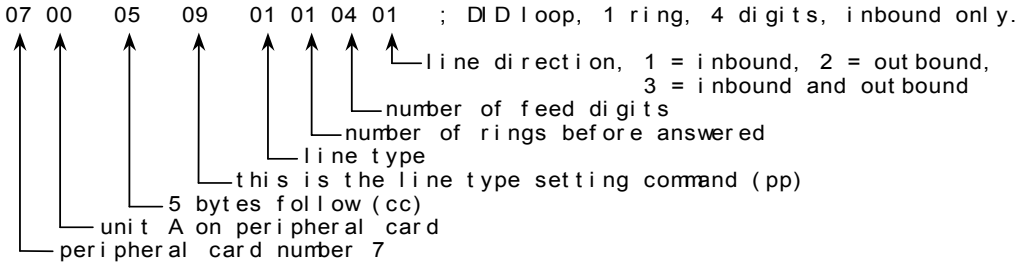
```
    aa uu cc pp qq qq ... qq ;comment text
where
    aa   peripheral card address/slot number (07-10 hex)
    uu   peripheral card unit number (00 for stations and trunks)
         (00 for trunk A of dual trunks, 01 for trunk B of dual trunks,
         00 up to 07 for multiport serial cards)
    cc   parameter count  (number of values "pp" and "qq" that follow)
    pp   parameter code   (described in sections below)
    qq   parameter values (described in sections below)
         this may require a 16-bit number and is coded as two bytes
    ;    rest of this line is a comment
```

## Trunk Card OPARAM Codes

For Trunk Card Software Versions 4K (single card) & 6F3 (dual card) see Table 33. Please note that "**" indicates the default setting for a parameter.

For each telephone line the `oparam.cds` file has a line similar to Figure 49.

*Figure 49: OPARAM Code Line Description*


07 00 05 09 01 01 04 01 ; DID loop, 1 ring, 4 digits, inbound only.
line direction, 1 = inbound, 2 = outbound,
3 = inbound and outbound
number of feed digits
number of rings before answered
line type
this is the line type setting command (pp)
5 bytes follow (cc)
unit A on peripheral card
peripheral card number 7

The possible line types are listed in Table 29 on page 226.

The following lines provide an example of two typical trunk definitions from the `opram.cds` file.

```
; Trunk 7A:
;
; block 0, service code 3,  no adder, 0000000 through 9999999 all valid
07 00   10   08   00 03 00    00 00 00 00   00 00 00 00   00 98 96 7F
07 00   05   09   02 01 07 01    ; DID WINK, 1 ring, 7 digits, can answer
; Trunk 7B:
;
; block 0, service code 3,  no adder, 0000000 through 9999999 all valid
07 01   10   08   00 03 00    00 00 00 00   00 00 00 00   00 98 96 7F
07 01   05   09   02 01 07 01    ; DID WINK, 1 ring, 7 digits, can answer
```

*Table 28: Trunk Card OPARAM Codes*

| Meaning | cc | pp | qq ... |
|---|---|---|---|
| Alarm dialer DID access number (Ademco Fast format assumed) | 05 | 25 | nn nn nn nn<br>Set the DID number to answer alarm dialer calls, default is 3B 9A C9 FF (= 999999999, an impossible number). Example: for 820-6363 to be the number for an alarm dialer to call use: 00 7D 38 1B |
| Allow central software to completely control ringback | 02 | 21 | **00 = trunk card starts ringback as soon as feed digits are seen (this is default - and is how existing code worked)<br>01 = trunk card does no independent ringback, it will only ringback when central tells it to AND the trunk card will not delay 1+ seconds before reporting the call to central |
| Allow central software to control answer supervision | 02 | 20 | **00 = trunk card answer supervises as soon as feed digits are seen (this is default - and is how existing code worked)<br>01 = trunk card does no independent answer supervision - central must send opcode 3A |
| Alpha acknowledgement delay | 02 | 32 | nn = 00 to 0F, delay time in seconds (0 to 15)<br>00 = disables delay time |
| Alpha input terminator | 02 | 26 | **0D = Default, carriage return (CR or Enter) is terminator<br>XX = any other value-the terminator character, for example, 03 for Ctrl-C |
| Alpha logon prompt terminator and maximum logon attempts | 03 | 2B | LL tt<br>LL = sets prompt for TAP logon<br>00 = ID = (default)<br>01 = ID =<CR><br>02 = ID =<CR><LF><br>03 = ID =<LF><CR><br>tt = sets max logon attempts for a TAP session<br>00 to FF = 0 to 255, zero means unlimited |
| Alpha logon timeout (applies to dual trunk only) | 02 | 14 | nn = # seconds between characters<br>00 = disable timeout, 0 to 83 (131 decimal)<br>(**default = 1E = 30 seconds) |

(**) = default value for parameter

Table 28: Trunk Card OPARAM Codes (continued)

| Meaning | cc | pp | qq ... |
|---|---|---|---|
| Alpha max transactions per message | 02 | 33 | 00 to FF = 0 to 255, zero indicates unlimited transactions |
| Alpha password | n+1 | 10 | ASCII password string of length n<br>(**default = no password) |
| Alpha terminator for transaction messages and response codes | 03 | 2C | tt rr<br>tt = terminator for TAP transaction messages<br>00 = <CR> (default)<br>01 = <CR><LF><br>02 = <LF><CR><br>03 = <LF><LF><CR><br>04 = <LF><br>rr = sets terminator for TAP response codes<br>00 = <CR> (default)<br>01 = <CR><LF><br>02 = <LF><CR><br>03 = <LF><LF><CR><br>04 = <LF> |
| Alpha timeout | 02 | 11 | **00 = timeout disabled<br>01 = timeout enabled - fixed at 30 sec (11 is for single trunk only, and is ignored by dual trunk.) |
| Alpha Transaction messages | 02 | 0D | 00 = messages disabled<br>**01 = messages enabled |
| Answer preference for end-to-end lines and for DID overdial | 02 | 02 | **00 = DTMF overdial preferred<br>01 = Modem carrier preferred<br>02 = (Single trunk only, version 4g, and lines (new for DID) later) Allow modem when no overdial<br>03 = Overdial only |
| Beep prompt for pager # | 02 | 03 | **00 = No beep<br>01 = Beep (PBX beep) |
| Debug mode | 02 | 12 | **00 = off |
| Decode “Reversed” Dial Pulses | 02 | 1D | **00 = decode in standard way (1 pulse generated by dialing 1, 9 pulses by dialing 9)<br>01 = decode reversed dials (1 pulse generated by dialing 9, 9 pulses by dialing 1) (for international support) |
| Dial click option | 02 | 0E | **00 = no dial click card<br>01 = dial click card present |

(**) = default value for parameter

Table 28: Trunk Card OPARAM Codes (continued)

| Meaning | cc | pp | qq ... |
|---|---|---|---|
| Dial Click Timing<br>(applies to dual trunk only) | 03 | 15 | ("cc = 03" is for newer Dual Trunk codes, Rev. 6d4 and later.)<br>byte 1 = NOZONE - ignore click events this long after click. Default: 12 ms (0C hex)<br>byte 2 = OKZONE - wait this long after NOZONE for another click to occur. Default: 94 ms (5E hex)<br>Notes: 1. Programming a 0 for any dial click value leaves the setting on the dual trunk card unchanged.<br>2. If the dial click option card is not installed, an "opcode error" (01) will result.<br>3. Default dial click parameters provide 8 to 11 pps with 58% to 64% break. |
| Disable owner's access<br>(DTMF 0) | 02 | 24 | **00 off - DTMF 0 is reported<br>01 on - DTMF 0 will not be reported during a prompt<br>02 DTMF 0 will be remapped |
| DTMF * options | 02 | 27 | **00 = "normal" handling of DTMF *<br>01 = DTMF * will always be interpreted as a dash "-"<br>02 = same as 01, except a ** digit(s) sequence will be interpreted as a canned message lookup instead of two dashes |
| DTMF minimum digit time<br><br><br><br>Alternate: | 03<br><br><br><br>02 | 1F | byte 1 = minimum time DTMF digit must last before it is considered valid, less time and it will not be reported (40 ms default).<br>byte 2 = 01-Enable, 00-Disable, DTMF suppression<br>byte 1 = same as byte 1 above |
| Enable the MF Decode Option | 02<br><br><br><br>03<br><br><br><br><br><br><br><br>04 | 1B | **00 = decode either pulse or DTMF feed digits<br>01 = decode only MF digits<br>20 = decode MF R2 sequence A<br>21 = decode MF R2 sequence B<br>02 nn = FGC MF feed digits.<br>03 nn = FGD MF feed digits.<br>04 nn = option 1 + option 3 (If only the number of feed digits specified in line type arrive in the first feed received, call progresses as an 01-type feed.)(If additional digits are received, the string is assumed to be an ANI and the terminal looks for a second feed.)<br>22 nn = MF R2 sequence C<br>23 nn = MF R2 sequence D, nn is the number of COS digits in the ANI feed (nn_9)<br>20 nn nn = decode MF R2 sequence A<br>byte 1 = valid number in range = 06<br>byte 2 = invalid number range = 05 |

(**) = default value for parameter

Table 28: Trunk Card OPARAM Codes (continued)

| Meaning | cc | pp | qq ... |
|---|---|---|---|
| Enable the PES<br>Model 103 option | 02 | 1E | **00 Normal trunk operation<br>01 Model 103 enabled<br>Note: Also requires correct trunk code, modem chip, TRUNKS.CUS settings, and line type 01.<br>02 Ademco Fast DTMF alarm dialer is connected.<br>04 UK alarm dialer |
| FASTNet packet collection mode | 02 | 28 | 00 = off (default)<br>01 = on |
| Minimum number of feed digits required for DID feed | 02 | 23 | nn default is same number as number of feed digits in oparam 09 - oparam 09 must be programmed first |
| Minimum overdial digits of subscriber Id for end-to-end or DID overdial access | 02 | 22 | nn minimum number of overdial digits - if this many digits not heard the call will be rejected - default is 1 |
| Modem Protocol | 02 | 1A | **00 = Bell protocol<br>01 = CCITT protocol<br>NOTE: you must set this parameter before setting baud rate. |
| Modem tones | 02 | 0A | **00 = answer tone pairs<br>01 = originate tone pairs |
| No operation | 01 | 00 | None |
| No operation | 01 | 04 | None |
| Overdial DID<br>(allow a DID number to accept overdials as if it were an end to end line) | 07<br><br><br><br>06 | 18 | aa dd nn nn nn nn<br>aa 00 = do not add adder into overdial<br>01 = add adder in<br>dd = maximum number of digits of overdial to allow, maximum is 20 (14 HEX)(fewer with timeout o.k.), when 8 or more digits are used only the last 7 are used for subscriber ID lookup<br>nn nn nn nn = the DID number to treat as end to end - in HEX, e.g. 261-0000 = 00 27 D3 50<br>The older form of parameter 18 still is allowed, with the adder not being added in to the overdial, as follows:<br>dd nn nn nn nn<br>(For single trunk and pre-6E dual trunk) As above, but adder is used, and fewer digits are not allowed. |
| Overdial Timeout (for dual trunk only)[3] | 03 | 19 | nn nn = timeout between overdial digits<br>(**default = 13 88 = 5000 msec) |
| Serial/modem parity | 02 | 0C | **00 = even parity (7 bit)<br>01 = odd parity (7 bit)<br>02 = no parity (8 bit) |

(**) = default value for parameter

Table 28: Trunk Card OPARAM Codes (continued)

| Meaning | cc | pp | qq ... |
|---|---|---|---|
| Serial/modem speed | 02 | 0B | **00 = 300 baud Bell 103/CCITT V.21<br>**01 = 1200 baud Bell 212/CCITT V.22<br>02 = 9600 baud<br>03 = 150 baud (for TNPP compatibility)<br>04 = 600 baud CCITT V.22-600<br>05 = 2400 baud (Multiport only)<br>06 = 4800 baud (Multiport only)<br>**Note:** You must set the baud rate BEFORE setting line type (parameter 09). Please note that CCITT vs. Bell is set by parameter 1A, and if used must be set before setting serial/modem speed. Note that parameters 03 and 04 are available only on the Dual Trunk at this time. Single trunk defaults to 300 except for Line Type 11, which defaults to 1200 for a serial port. A single trunk modem does not do 1200 baud. Dual trunk defaults to 1200. |
| TANS[2] | 03 | 06 | nn nn = # milliseconds delay after supervision, see Table 30 on page 227 |
| TCON[2] | 03 | 05 | nn nn = # milliseconds that connect signal must be stable to recognize start of incoming call, see Table 30 on page 227 |
| TDIS[2] | 03 | 07 | nn nn = # milliseconds that disconnect signal must be present before dropping call For DID, loss of loop current, see Table 30 on page 227 |
| Telco line parameters[1,2] | 05 | 09 | byte 1 = line type, see following table.<br>2 = rings before answer (01 to 09 for end-end line type only)<br>3 = number of feed digits (00 to 20)(14 HEX) when more than 8 digits are used, only the last 7 are used for subscriber ID lookup, note this does not apply to outbound trunks<br>4 = line permissions<br>01 = in only<br>02 = out only<br>03 = two way trunk |
| Valid digit blocks | 10 | 08 | byte 1 = block number to program (00-09)<br>2 = block service code (for DID and E&M; see Table 31 on page 227)<br>3 = not used<br>4-7 = prefix/adder for block<br>8-11 = low bound of valid digits<br>12-15 = high bound of valid digits |
| Voice Compatibility (for dual trunk only) | 02 | 1C | **00 Versions 297 & later<br>01 Versions 295 & earlier |

(**) = default value for parameter

Table 28: Trunk Card OPARAM Codes (continued)

| Meaning | cc | pp | qq ... |
|---|---|---|---|
| VOX disconnect | 02<br><br><br><br>03 | 01 | **00 = full voice time<br>01 = disconnect on silence<br>02 = disconnect on silence or regular tone (“bam analysis)<br>02 nn where nn = the number of tone bursts to disconnect on. range = 3 to 0A** |
| VOX disconnect DTMF (DTMF digits that end voice recording) | 02<br><br><br><br><br><br>04 | 29 | 0 = Long DTMF *<br>1 = DTMF 1 then 2 within 1.1 seconds<br>2 = Long DTMF #<br>3 = Long DTMF * or DTMF 1 followed by 2 (within 1.1 seconds)<br>4 = Long DTMF #<br>5 = Long DTMF # or Long DTMF *<br>aa bb bb<br>aa = option from list above<br>bb bb = time in milliseconds that DTMF # or * must last before VOX disconnects |
| VOX disconnect threshold (applies to dual trunk only) | 02 | 13 | nn = relative threshold<br>(**default = 64 = .09 Vrms) |
| VOX disconnect timeout | 03 | 0F | nn nn = # milliseconds of silence (or regular tone if VOX disconnect [parameter 01] is set to 02) that will cause a disconnect |
| Wink Start<br>(for dual trunk only)<br>(TWINK) | 03 | 16 | nn nn = battery reversal pulse width (msec)<br>(**default = 00 F0 = 240 msec) |

(**) = default value for parameter

Special notes:

[1] Trunk cards check their configuration matrix plug to verify that the programmed Line Type above matches. If not, programmed arguments above are ignored by the trunk card and the default settings are used.

[2] Command 09 should come before setting any timing values (parameters 05, 06, 07).

[3] For E-E line types, caller may enter less than the programmed number of digits; these will be accepted if the caller waits for the digit timeout (parameter 19). (Dual trunk only, rev 6E1 and later.)

*Table 29: Possible Line Types*

| Number for Line Type | Name of Line Type | Number of Rings has Meaning | Number of Feed Digits has Meaning | Line Directions Allowed | Matrix Plug |
|---|---|---|---|---|---|
| 00 | Undefined | — | — | — | — |
| 01 | DID Immediate Start | NO | YES | IN | DID |
| 02 | DID Wink Start | NO | YES | IN | DID |
| 03 | Zetron Ring Box(6) | NO | YES (IN) | IN & OUT | DID |
| 04 | Same as 03, but NO dial tone | | | | |
| 05 | Connect to DID immediately | NO | NO | OUT | (1) |
| 06 | Connect to DID wink | NO | NO | OUT | (1) |
| 07 | Connect to a M45, M46, or M48 Local Phone Port | NO | NO | OUT | (2) |
| 08 | End-End ring (POTS) | YES | YES | IN & OUT | E-E |
| 09 | Ground Start | NO | YES | IN | GND ST(5) |
| 0A | Special Ground Start, handling is like DID | NO | YES | IN | GND ST |
| 0B | M810 E-E Inbound | NO | YES | IN & OUT | E&M |
| 0E | VNET A Sender | NO | YES | IN | E&M |
| 0F | VNET B Sender | NO | YES | IN | E&M |
| 10 | Local Phone | NO | YES | IN | DID |
| 11 | Local Modem (obsolete) | NO | NO | IN | (4) |
| 12 | PBX Wink Stop | NO | YES | IN | DID |
| 13 | Local Serial (obsolete) | NO | YES | IN | (4) |
| 13 | Same as 03 except UK ringout cadence | | | | |
| 14 | Same as 04 except UK ringout cadence | | | | |
| 14 | Network USA Satellite | NO | NO | IN | (4) |
| 16 | Same as 18 but with dial tone | | | | |
| 17 | Same as 19 but with dial tone | | | | |
| 18 | E&M Immediate Start | NO | YES | IN & OUT | (3) |
| 19 | E&M Wink Start | NO | YES | IN & OUT | (3) |

Notes:

[1] The end to end loop start with answer supervision, generic matrix plug is used - it has two large capacitors and an optoisolator on it.

[2] The M4X generic matrix plug is used - it is the only generic matrix plug with a jumper, it also has an optoisolator on it.

[3] Either the E&M position of the standard matrix plug is used, or the E&M generic matrix plug is used (it is the only generic matrix plug with a ballast lamp on it), or the 4-wire audio E&M dual trunk is used - you use the standard matrix plug to hook to a PBX, the generic to hook to a

TELCO, one of each to connect a M2000 to another M2000, and a 4-wire card to connect to a M49 (also preferred for M2000 to M2000 connections).

[4] For old single trunks only, no longer used, except for Multiport serial cards (line type 11).

[5] Special matrix plug required for single trunks.

[6] Also used for Alarm Monitoring when alarm dialer is hooked directly to trunk.

Refer to *Theory of Operation* on page 149 in this manual, for more information on TCON, TANS, and TDIS.

*Table 30: Telephone Timing Defaults*

| Line Type (hex) | TCON (msec) | TANS (msec) | TDIS (msec) |
|---|---|---|---|
| 00 | 0 | 0 | 0 |
| 01 | 60 | 120 | 360 |
| 02 | 70 | 120 | 360 |
| 08 | 0 | 1000 | 2500 |
| 09 | 1000 | 120 | 360 |
| 10 | 60 | 120 | 360 |
| 11 | 0 | 0 | 0 |
| 18 | 60 | 120 | 360 |

*Table 31: Block Service Code Actions for DID and E&M Lines*

| Block Code | Service Code Actions for DID Lines |
|---|---|
| 00 | Not a valid block code, behaves as if not entry was made, see default setting 02 |
| 01 | Supervise but ignore |
| **02 | Supervise, answer with warning tone, hang-up |
| 03 | Supervise, answer, and proceed with call |

**Note** Starting with software version 6F9, the same Block Service Codes can be used with trunks configured for End-to-End lines. The following table shows the responses received when these codes are used with End-to-End lines.

| Block Code | Service Code Actions for End-to-End Lines |
|---|---|
| 00 | Not a valid block code, behaves as if not entry was made, see default setting 02 |
| 01 | Immediately hang up on caller |
| **02 | Answer with warning tone (10-second whooping tone), then hang-up |
| 03 | Valid number, proceed with normal call handling |

### Example: Prefix/Adder, Low Bound, High Bound for DID Line

Suppose our paging terminal receives 3-digit DID service in the number ranges 644-1300 to 644-1499 and 555-1000 to 555-1199; (These are also the 7-digit subscriber id numbers that will be entered in the database). If a telephone call arrives at the telco trunk card with any three digits not in the range 000 to 199 or 300 to 499, the trunk will play the whoop-whoop! tones.

For valid digits, we need to program two blocks as follow:

| Low Bound | | High Bound | | Prefix/Adder | | Comments |
|---|---|---|---|---|---|---|
| Dec | Hex | Dec | Hex | Dec | Hex | |
| 300 | 01 2C | 499 | 01 F3 | 6441000 | 00 62 48 28 | 644-1300 to 644-1499 |
| 0 | 00 00 | 199 | 00 C7 | 5551000 | 00 54 B3 98 | 555-1000 to 555-1199 |

The actual lines in the oparam.cds ASCII text file would look like:

```
; trunk 7
;   644-1300 to 644-1499 enabled
;   555-1000 to 555-1199 enabled
07 00  10  08 00 03 00  00 62 48 28  00 00 01 2C  00 00 01 F3
07 00  10  08 01 03 00  00 54 B3 98  00 00 00 00  00 00 00 C7
```

### Example: Prefix/Adder, Low Bound, High Bound for End-End Line:

Suppose we want 1000 subscribers on an overdial station line. We program for 3-digit feed (000 to 999 overdial to match the id fields in the subscriber database).

| Low Bound | | High Bound | | Prefix/Adder | | Comments |
|---|---|---|---|---|---|---|
| Dec | Hex | Dec | Hex | Dec | Hex | |
| 0 | 00 00 | 999 | 03 E7 | 0 | 00 00 00 00 | 000 to 999 overdial |

The actual lines in the `oparam.cds` file would look like:

```
; trunk 8
;    000 to 999 overdialed
08 00  10  08 00 03 00  00 00 00 00  00 00 00 00  00 00 03 E7
```

## Station Card OPARAM Codes

For Station I Card Software V7E0 and Station II Card Software V1A9.

*Table 32: Station Card OPARAM Codes*

| Meaning | cc | pp | qq ... |
|---|---|---|---|
| — | — | — | NOTE: The batching parameters: 0A, 0B, 0C, 0D, 0F, 10 and 13, are no longer used (they are used for version 300 and earlier). They are ignored if set. |
| (reserved) | | 35 | |
| 2-tone batch size | 02 | 2E | nn = maximum number of 2-tone pages to send from a single batch (for group calls). Default is 3B (59 decimal). |
| 2-Tone batching (obs) | 02 | 0A | nn = # seconds in batching period Default = 30 sec |
| 2-tone format inter-page delay | 03 | 41 | **00 00** through **27 10** (0 to 1000 ms)<br>Defaults: **03 E8** (1000 ms) for all code versions but 601-1149<br>**0B B8** (3000 ms) for code version 601-1149, Public Safety version |
| 5 or 10 padding multiple for POCSAG numeric pages (version 1B0 and later) | 02 | 3b | 00 = Padding multiple for the numeric message is 5<br>>= 01 = Padding multiple for the numeric message is 10 (range is from 00** to FF) |
| 5/6-tone batch size | 02 | 24 | nn = maximum number of 5/6-tone tone only pages that may follow a single preamble. Default is 1F (31 decimal). |
| 5/6-Tone batching(obs) | 02 | 0B | nn = # seconds in batching period Default = 30 sec |
| Amplitude for Tone Generation (version 1B0 and later) | 02 | 39 | nn = Set the output level for tone generation, as a percentage of full amplitude<br>**default = 64 (hex) = 100 decimal |
| ANT TX control word(s) (obsolete at V1A9) | 07 | 2B | byte 1 = TX Zone to program 0-15 or 16 for TX off word.<br>bytes 2-6 = Control word information, 40 bits |
| Batching multiplier time (obs) | 02 | 13 | nn = multiply each batching time by this number to get the real batching time in seconds. default = 1 range: 1 to 255 |
| Breakthrough hold off | 03 | 23 | byte 1,2 = maximum time to wait for paging to complete before a breakthrough page can force a halt to paging. 1 ms per increment of this value. Default is 03E8 (1000 decimal) for 1 second. |
| Busy time (TBSY) | 03 | 01 | nn nn = # milliseconds that COR and BUSY must be clear before radio is ready (**default = 2 seconds) (0 will ignore COR and BUSY) |

(**) = default value for parameter

Table 32: Station Card OPARAM Codes (continued)

| Meaning | cc | pp | qq ... |
|---|---|---|---|
| Camp on busy zone | 0A | 2F | byte 1 = Zone to program<br>byte 2,3 = Initial camp time for busy zone. 0-32000 sec, 0 = infinite, default = 0.<br>byte 4,5 = camp time increment for each subsequent key attempt on a busy zone. 0-32000 sec, default = 0.<br>byte 6,7 = maximum time to camp on a busy zone. 0-32000 sec, default = 300. Do not set to 0; make sure >= to initial camp time.<br>byte 8,9 = time to wait until trying this zone again if it was busy. 0-32000 sec, default=15. |
| Debug | 01 | 17 | None |
| Digital data polarity | 02 | 06 | 00 = inverted data<br>01** = non-inverted data |
| DP6000 Parameter version 1B2 and later | 03 | 3C | Byte 1 = Tone Burst Switching **default = 0, 0 = off, 1 = on<br>Byte 2 = The number of times to send the code block **default = 1 |
| FIFO Batch | 02 | 3F | 00 = Normal batch (**default)<br>01 = FIFO batch |
| FLEX Re-synchronize Duration | 02 | 3E | nn = the number of cycles of emergency resync that must be sent given an equivalent number of FLEX Frames to fill with resync (the range is from 00 to FF)<br>**default = 0F (hex) = 15 decimal |
| FLEX Zone | 03 | 3D | byte 1 = Set FLEX Zone (range is from 0 to 15)<br>byte 2 = FLEX Timer (range is from 1 to 3)<br>**default is that all FLEX Zones are disabled |
| Gap time | 03 | 27 | byte 1,2 = Gap time (TGAP) in ms between dropping xPTT and raising yPTT during mode changes. This time used to be controlled by Mode time. Default is 00 FA (250ms). Mode time now controls time from yPTT to data or audio. |
| Golay batching (obs) | 02 | 0D | nn = # seconds in batching period default = 30 sec |
| Grant between pages | 02 | 16 | **00 = grant only on Terminal Busy input<br>nn = always drop TX after radio has been transmitting more than nn minutes. |

(**) = default value for parameter

Table 32: Station Card OPARAM Codes (continued)

| Meaning | cc | pp | qq ... |
|---|---|---|---|
| HSC battery saving | 0B<br><br><br><br><br><br><br><br><br><br><br><br>0C | 0E | byte 1 = # seconds in battery save interval<br>default = 30 sec<br>2 = # of repeats for battery saver transmissions<br>(00 to 02) default = 00<br>3 = tone table for battery saving (00 to 03, usually<br>00 for USA) default = 00<br>4 = service block for battery saver transmissions<br>(00 to 0A, 0A is wild card) default = 0A<br>5-9 = 5 digit battery saver capcode (each digit 00<br>to 0A, 0A is wild card default = 0A 0A 0A 0A<br>A = battery saver mode<br>00 = off, 01 = send battery saver<br>02 = send battery saver, and range enable<br>default = 00<br>B = battery saver zone (00 to 0F) no default |
| Low Level Guard Tone Amplitude | 02 | 1D | nn = Low level guard tone level (LLGT) Changes in<br>1.5dB steps default = 17 hex (23 decimal)<br>Example:<br>0F 00 02 1D 1B ; Boost LLGT +6dB |
| Mode signal polarity | 02 | 05 | **00 = low value for digital page<br>01 = high value for digital page |
| Mode switching time (TMOD) | 03 | 04 | nn nn = # milliseconds delay before and after raising<br>ANA or DIG PTT before sending audio or data.<br>(**default = 00 EA = 250 msec) |
| Modem Guard Tone Level | 02 | 34 | nn = modem guard tone level expressed in hex as a<br>percentage with regard to the single tone output<br>level. Default = 32 (50 decimal) which yields<br>-6db wrt. |
| Modem type | 02 | 14 | 00** = Bell 202 FSK<br>01 = Bell 202 FSK equalized |
| Multitone clock format | 02 | 29 | 00 = 24 hr clock display<br>01 = 12 hr clock display |
| Multitone MK7 - set transmitter modulation (version 1A9 and later) | 02 | 36 | Normal NRZ data<br>Manchester encoded data default = 1 |
| Multitone MK7 - set system ID (version 1A9 and later) | 02 | 37 | Permissible values are 0 to 9<br>default = 0 |
| Multitone test mode | 02 | 2A | 00 = normal paging<br>01 = test mode, 15% slower data rate |

(**) = default value for parameter

Table 32: Station Card OPARAM Codes (continued)

| Meaning | cc | pp | qq ... |
|---|---|---|---|
| Multitone time call | 03 | 28 | byte 1 = zone for time call enable/disable<br>byte 2 = 00 to disable or 01 to enable (MK4 to 6)<br>byte 3 = 00 to disable or 01 to enable (MK7) |
| Multizone remote control stations | n+1 | 19 | byte 1 = RF zone to set (00 to 0F)<br>byte n = station to disable (01 to 0A) or group to enable (0B or 0C) or derived frequency (1F to FF) see Table 33 |
| Must page time | 03 | 21 | byte 1,2 = maximum time that a page may remain in the system before forcing a zone change. 512 ms for each increment of this value. Default is 00B0 (176 decimal) for 90 seconds. |
| NEC D2 batching (obs) | 02 | 0F | nn = # seconds in batching period default = 30 sec |
| NEC D3 batching (obs) | 02 | 10 | nn = # seconds in batching period default = 30 sec |
| No operation | 01 | 00 | None |
| Output Level for High Level Guard Tone (HLGT) generation (version 1B0 and later) | 02 | 3A | nn = Will set HLGT directly as a percentage of full amplitude<br>For Crescent HLGT = 1.5 x nn<br>For SCM HLGT = nn/2<br>**default = C2 (hex) = 194 (decimal) |
| Paging hold off time | 03 | 22 | byte 1,2 = minimum time that a page must remain in the system before causing a new key-up. Also used for the minimum time a page must be in the system to prevent a zone change when pages pending for other zones have not met the “must page” time. 512 ms per increment of this value. Default is 003B (59 decimal) for 30 seconds. |
| POCSAG alpha EOS char | 02 | 2D | nn = ASCII code to use for the End Of String terminator for alpha-numeric messages. This is specific to the pager in use and is not usually to be changed. Default is 04. Typical alternate is a space (20 hex). |
| POCSAG batching (obs) | 02 | 0C | nn = # seconds in batching period default = 30 sec |
| POCSAG batchsize limit | n+1 | 32 | byte 1 = 512 baud batch size limit.<br>byte 2 = 1200 baud batch size limit.<br>byte 3 = 2400 baud batch size limit. |

(**) = default value for parameter

Table 32: Station Card OPARAM Codes (continued)

| Meaning | cc | pp | qq ... |
|---|---|---|---|
| POCSAG mode | 0A<br><br><br>02 | 26 | 1 = mode, 00 is normal POCSAG mode. **01 is high reliable mode with warm-up.<br>2-3 = 512 baud warm-up frequency Hz. Default is 750 decimal.<br>4-5 = 512 baud warm-up # of bits to send. Default is 300 decimal.<br>6-7 = 1200 baud warm-up frequency Hz. Default is 1500 decimal.<br>8-9 = 1200 baud warm-up # of bits to transmit. Default is 300 decimal.<br>(Alternate)<br>00 = normal POCSAG mode.<br>**01 = high reliable mode with warm-up. |
| POCSAG out of range transmission zones | 03 | 31 | byte 1 = zone (00-0F)<br>byte 2 = 1-enable, 0-disable<br>Note: this is standard on a new station, a special on an old station. |
| POCSAG out of range transmissions. | 05 | 30 | byte 1 = range transmissions periodic rate in minutes<br>byte 2 = 512 baud 1-enable, 0-disable<br>byte 3 = 1200 baud 1-enable, 0-disable<br>byte 4 = 2400 baud 1-enable, 0-disable<br>Note: This is standard on a new station, a special on an old station. |
| POCSAG repeat function code | n+1 | 33 | byte 1 = 0 if setting for numeric, 1 if alpha<br>byte 2 = (1-4) replaces function 1 for repeats<br>byte 3 = (1-4) replaces function 2 for repeats<br>byte 4 = (1-4) replaces function 3 for repeats<br>byte 5 = (1-4) replaces function 4 for repeats<br>Default: repeats use the same function as the primary page. |
| POCSAG set system ID | 05 | 38 | nn nn nn... 20 bit system ID |
| Post Paging TX Hold Time | 03 | 1C | nn nn Transmitter hold time in ms. How long to wait for a new incoming page before unkeying the transmitter. Default: 100 msec |
| Priority multiplier | 02 | 20 | nn = multiplies the priority incremental time by 512 ms for each increment of this value. 00 disables priority operation. Default setting is 3B (59 decimal) for 30 seconds per increment of a subscribers priority assignment. |

(**) = default value for parameter

Table 32: Station Card OPARAM Codes (continued)

| Meaning | cc | pp | qq ... |
|---|---|---|---|
| Remote control mode | 02 | 07 | **00 = digital pin only with mode and relay control<br>01 = FSK modem audio<br>02 = PURC control tones with FSK modem audio<br>03 = Crescent control tones with FSK modem audio<br>04 = External transmitter-controller RTS/CTS handshaking<br>05 = Quintron TCM/SCM control tones with FSK modem audio<br>06 = Full handshake remote control with Request input enabled<br>07 = Multitone DTMF key<br>08 = ANT digital key<br><br>Note: Parameter 07 should always be set before parameter 08. |
| Repeat paging type | 02 | 2C | 00 = repeats entire page sequence (alert-voice, alert-voice)<br>01 = repeats of voice message only (alert-voice, voice) |
| Request hold time (TREQ) | 03 | 03 | nn nn = # milliseconds to hold request output asserted before looking for busy input.<br>(**default = 00 EA = 250 msec) |
| Request signal polarity | 02 | 11 | **00 = low value for request<br>01 = high value for request |
| Set Guard Tone | 03 | 1F | Byte 1 = Zone to set<br>Byte 2 = Guard tone frequency for the zone (both High & Low level):<br><br># name frequency<br>0 PURC/M66 2175<br>1 M66 HSC 2600<br>2 MISC 2675<br>3 QUINTRON 2875<br>Example:<br>0F 00 03 1F 02 01 ; Zone 2, 2600Hz GT |

(**) = default value for parameter

Table 32: Station Card OPARAM Codes (continued)

| Meaning | cc | pp | qq ... |
|---|---|---|---|
| Set Function Tone | 03 | 1E | byte 1 = Zone to set<br>byte 2 = Function tone # per table below<br># name freq.<br>0 f1 key 1950<br>1 f2 key 1850<br>2 PL dis 2050<br>3 mute f2 1750<br>4 unmute f2 1650<br>5 misc. 1550<br>6 misc. 1450<br>7 wildcard 1350<br>8 wildcard 1250<br>9 wildcard 1150<br>A wildcard 1050<br>B misc. 950<br>C misc. 850<br>D misc. 750<br>E misc. 650<br>F misc. 550<br>Example:<br>0F 00 03 1E 05 01 ; Zone 5, key F2 |
| Station ID call sign | n+2 | 09 | byte 1 = zone # for this Id (00 to 0F)<br>bytes 2 to n = ASCII string of Id chars (hex value)<br>Only uppercase letters, A-Z, and digits, 0-9, may be used. Refer to Appendix B for hex value of ASCII characters. (**default = no Id) |
| Station ID time | 02 | 08 | nn = # minutes between Id cycles<br>03 byte 1 = # minutes between ID cycles<br>byte 2 = mode (0=normal, 1=Id always,<br>2=Id if terminal or COR activity<br>04 byte 3 = WPM ID speed (default 20 {14 HEX}) |
| Station number and permissions | 03 | 18 | byte 1 = station channel number. For setting unique channel number for ZbaseW.<br>2 = station permissions, bit field:<br>01 = no voice channel for this station channel<br>02 = talkback enabled<br>03 = talkback enabled, no voice channel (card used ONLY for talkback) (310d4 & later)<br>Note: ancient systems had byte 1 and byte 2 with value 20. |

(**) = default value for parameter

Table 32: Station Card OPARAM Codes (continued)

| Meaning | cc | pp | qq ... |
|---|---|---|---|
| Talkback parameters | 08 | 1A | byte 1 = # of rings maximum to mobile, 4 sec per ring, 5 rings default (20 seconds of alert time), 1 - 127 allowed<br>byte 2 = mobile activity timeout, 30 second default, 1 - 255 allowed, 0 for no timeout<br>byte 3 = call limit timeout, 10's of seconds to allows, 18 10's default (180 sec = 3 minutes), 1 - 255 10's of seconds allowed, 0 for not timeout<br>byte 4 = seconds before mobile activity time-out to start warning beeps, 10 sec default, 0 - 255 allowed<br>byte 5 = 10's of seconds before call limit timeout to start warning beeps, 2 10's of seconds default (20 sec) 1 - 255 10's of seconds allowed<br>byte 6 = How to handle TX audio when COR is present:<br>0 = silence out TX<br>1 = mobile voice out TX<br>2 = busy tone out TX (privacy mode)<br>3 = phone out TX when COR (for full duplex talkback pagers)<br>byte 7 = 10ths of seconds to debounce COR before considering the talkback pager to have answered, 1 default, 0 - 10 allowed |
| TX grant time (TGRANT) | 03 | 12 | nn nn = # milliseconds transmitter goes away if busy input true default = 3 seconds |
| TX key up delay time (TKEY) | 03 | 02 | nn nn = # milliseconds to wait after keying AUX PTT to keying ANA or DIG PTT.<br>(**default = 1 second) |
| Voice message beep | 02 | 15 | 00 = no beep over radio after each voice msg<br>**01 = 1000 Hz beep after each voice message |
| Watchdog timeout | 03 | 25 | byte 1,2 = maximum time the transmitter may remain keyed on a single authorization. Authorization is granted at the start of paging, talk time, mobile ringout, mobile activity. 1 second per increment of this value. Default is 012C (300 decimal). Use FF FF (6500 seconds) to effectively disable this. |

(**) = default value for parameter

Table 32: Station Card OPARAM Codes (continued)

| Meaning | cc | pp | qq ... |
|---|---|---|---|
| Zone parameters | 0A | 1B | byte 1 = zone to set (00 to 0F)<br>byte 2 = mode: 0 = No M68, use default parameters<br>1 = No M68, use following parameters<br>2 = M68 key, use default parameters<br>3 = M68 key, use following parameters<br>byte 3,4 = Busy Time (TBSY), in msec (See parameter 01)<br>byte 5,6 = Mode Switching Time (TMOD), in msec<br>(See parameter 04)<br>byte 7 = Digital Polarity: 1 = normal, 0 = inverted<br>(See parameter 06)<br>byte 8 = Key type 0-8 (See parameter 07)<br>byte 9 = Grant between pages, minutes (0=none)<br>(See parameter 16) |
| | 0E | | The above values, plus the following:<br>byte 10, 11 = Grant Time (TGRANT) in msec<br>(see parameter 12)<br>byte 12, 13 = Gap time (TGAP) in msec (see parameter 27) |

(**) = default value for parameter

*Table 33: Setting Control Tones for Multizone Remote Stations*

| byte n (hex) | Station Number GroupI GroupII GroupIII | | | Frequency (decimal) |
|---|---|---|---|---|
| 01 | 1 | 11 | 21 | 1750 Hz |
| 02 | 2 | 12 | 22 | 1650 Hz |
| 03 | 3 | 13 | 23 | 1550 Hz |
| 04 | 4 | 14 | 24 | 1450 Hz |
| 05 | 5 | 15 | 25 | 1350 Hz |
| 06 | 6 16 26 | | | 1250 Hz |
| 07 | 7 17 27 | | | 1150 Hz |
| 08 | 8 18 28 | | | 1050 Hz |
| 09 | 9 19 29 | | | 950 Hz |
| 0A | 10 20 30 | | | 750 Hz |
| 0B | Function Tone | | | 1950 Hz |
| 0C | Group I Enable tone | | | 2175 Hz |
| 0D | Group II Enable tone | | | 1850 Hz |
| 0E | Group III Enable tone | | | 2050 Hz |
| 0F to 1E | Invalid, do not use | | | — |
| 1F to FF | Derived Frequency = n * 10 (decimal)<br>that is: if n = 80 (hex), then Freq. = (128*10) = 1280 Hz | | | |

## Multi-port Serial Card OPARAM Codes

**For Multi-Port software version 8B2B**

Operating parameters (oparams) are a subset of those implemented in trunk cards. Refer to the Trunk Card codes in Table 28 for additional information. Please note that, the baud rate and parity must be set before setting the line type, otherwise the first logon will be at the default baud rate.

*Table 34: Multiport Card OPARAM Codes*

| Meaning | cc | pp | qq ... |
|---|---|---|---|
| Allow Terminator Selection | 02 | 2C | 00 = <CR><br>01 = <CR><LF><br>02 = <LF><CR> (**default)<br>03 = <LF><LF><CR> |
| Alpha entry key timeout | 02 | 14 | nn = number of seconds allowed between character entries (range 0 to 131 seconds)<br>00 = disables timeout<br>**default = 30 seconds = 1E (hex) |
| Baud rate | 02 | 0B | 00 = 300<br>01 = 1200<br>02 = 9600<br>05 = 2400<br>06 = 4800<br>07 = 19200 (supports version 8b0g or later) |
| Character bitmap definition for key rejection | 02<br><br><br>n+2 | 2A<br><br><br>2A | ab a = 0 for numeric set, 1 for alpha set<br>b = 0 to ACCEPT all characters,<br>1 to REJECT all characters<br>ab nn... 2 to ACCEPT the following characters<br>3 to REJECT the following characters<br>4 set bits in mask to default |
| Force manual entry (Alpha message length from 0 to 500) | 02 | 1E | **00 = normal mode, logon required<br>01 = forced manual entry mode, no logon required<br>02 = Multiple Channel Access System (MCAS) mode<br>03 = Disables the Manual mode |
| Key input timeout | 03 | 19 | nn nn = Timeout between overdial digits<br>**default = 13 88 = 5000 msec |
| Line type | 05 | 09 | byte 1 = 11 or 20<br>11 = Local Serial, 20 = External Modem<br>byte 2 & 3 = bytes are ignored, set to 00<br>byte 4 = Permissions must be set to 01 |
| Message option | 02 | 0D | 00 = Disable the transaction message<br>01 = Enable the transaction message |

(**) = default value for parameter

Table 34: Multiport Card OPARAM Codes (continued)

| Meaning | cc | pp | qq ... |
|---|---|---|---|
| Parity, serial port | 02 | 0C | 00 = Even parity (7 bits) **default<br>01 = Odd parity (8 bits)<br>02 = No parity (8 bits) |
| Password, setting | n+1 | 10 | nn... = ASCII password string of length n (n ranges from 0 to 6) **default = 00 = no password |
| Select alpha manual input terminator - or - Modify all editing keys | 02<br><br>06 | 26<br><br>26 | nn = Define manual input terminator **default = 0D<br>byte 1 = Define manual input terminator **default = 0D<br>byte 2 = Define backspace character **default = 08 (hex)<br>byte 3 = Define delete character **default =7F<br>byte 4 = Define Control-X character **default = 18 (hex)<br>byte 5 = Define Control -W character **default = 17 (hex) |
| Set TAP logon prompt compatibility | 06 | 2B | byte 1 = Wait for <CR> from device before sending the "ID=" logon prompt<br>00 = off, no wait (default)<br>01 = on, wait for <CR><br>byte 2 = Set prompt for TAP logon<br>00 = ID= (default)<br>01 = ID=<CR><br>02 = ID=<CR><LF><br>03 = ID=<LF><CR><br>byte 3 = Set maximum number of attempts for a TAP session (0 to 255, 0 = unlimited)<br>00 to FF (default = 00)<br>byte 4 = Sets handling or <CR> after paging terminal issues TAP "ID=" logon prompt<br>00 = reissue "ID=" logon prompt<br>01 = no response<br>02 = send <NAK><br>byte 5 = Set handling of unexpected input (something other than <CR>)<br>00 = no response (default)<br>01 = <NAK> |
| Set terminator for TAP transaction message | 03 | 2C | byte 1 = set terminator for TAP transactions<br>00 = <CR> (default)<br>01 = <CR><LF><br>02 = <LF><CR><br>03 = <LF><LF><CR><br>byte 2 = Set terminator for TAP response codes<br>00 = <CR> (default)<br>01 = <CR><LF><br>02 = <LF><CR><br>03 = <LF><LF><CR> |

(**) = default value for parameter

Table 34: Multiport Card OPARAM Codes (continued)

| Meaning | cc | pp | qq ... |
|---|---|---|---|
| Select Carrier Timings | 05 | 2E | bytes 1 & 2 = Carrier seen<br>(**default = 03 E8 (hex) = 2 seconds)<br>bytes 3 & 4 = Carrier lost<br>(**default = 03 E8 (hex) = 2 seconds) |
| Select DTR wait | 05 | 2D | bytes 1 & 2 = DTR low wait (**default = 1000)<br>bytes 3 & 4 = DTR high wait (**default = 1000) |
| Select modem hang up guard time | 03 | 2F | bytes 1 & 2 = Guard time in 0.1 second increments<br>**default = 1E (hex) = 3 seconds |
| Select whether to wait for <CR> before “ID=”<br><br>(Also allow setting terminator for ID=, number of logon tries, and setting <NAK> behavior) | 06 | 2B | byte 1 - 00** = OFF, 01 = ON<br>byte 2 - 00** = None, 01 = <CR>, 02 = <CR><LF><br>byte 3 - Number of logon tries (**default = 03)<br>byte 4 - How to handle subsequent <CR> inputs<br>00 = reissue “ID=”<br>01 = no response<br>02 = <NAK> (**default)<br>byte 5 - How to handle unexpected input other than <CR> after “ID=”, for example five characters such as “12345”<br>00 = no response<br>01 = <NAK> (**default) |
| Set Motorola People Finder Emulation mode | 02<br><br><br><br>04 | 31<br><br><br><br>31 | 00 = Zetron manual mode (**default)<br>01 = Motorola People Finder Emulation manual mode (contact Zetron Technical Support for more information on using this mode)<br>01 = Same as 01 above<br>Byte 2 = Zetron COMP1, the fixed length pager number field will be used (the valid range is from 01 to 07) , or, if set to 0, it is of variable length<br>Byte 3 = Motorola People Finder COMP2, the delimiter character will be used (the valid ASCII character is from 0 to 70 in HEX |

(**) = default value for parameter

The following lines of code are an example of a Multiport card set up for TAP outdial.

```
;   TAP Outdial - Card 14:
;
;           batch dst  Qlim Yellow  Orange     Red     Scale
0E 00  0B   01   00    01  00 00    00 0F    03 84    00 02 ; NEW DEFAULT
0E 00  0B   01   01    03  00 3C    00 F0    03 84    00 1E ; OLD DEFAULT
; dst = 0, Qlim = 1, Yell = 0min, Org = 15sec, Red = 15mim, Scale = 2dec.
; dst = 1, Qlim = 3, Yell = 1min, Org = 4min, Red = 15mim, Scale = 30dec.
;
;         dialing dst Baud bits CD-wait
0E 00  05   02   00    00  00  5A
0E 00  05   02   01    00  00  5A
; Dst = 0, Baud = 0300, Bits = 7data Even parity, CD-wait = 1.5min
; Dst = 1, Baud = 1200, Bits = 7data Even parity, CD-wait = 1.5min
;
; ************ 10 Digit Tap-Out Dial ************
;
;        cc  pp  dest   area code ( 425 )
; 0E 00  05  0D   00    34 32 35         ; Tap-Out Area Adder.
;
; ************ Enable Disable Modem Option ***********
; 0E 00  02  0E  00 ; Enables Direct Connect Mode
;
;          dialstr dst
0E 00  07   03    00   30 30 30 38  00                  ; Loopback Test
0E 00  0C   03    01   39  2C  35 37 36  35 31 39 39 00 ; 9,576-5199
;  Dst = 0, phone # = 0008 Loopback Test
;  Dst = 1, phone # = 9,576-5199  - Test back to terminal
;
;       session   dst ^S^Q IDwait LoginCR MaxCR PageCall Mode GoWait PW
0E 00  0A   04   00    00   00     07     06    10       01    03   00 ; NEW
0E 00  0A   04   01    00   00     02     06    10       01    03   00 ; OLD
; Dst = 0, ^S^Q = flow ctrl off, IDwaitforID = 0sec, LoginCR = 2sec, MaxCR = 6,
;           PageCall = 16, Mode = PG1, GoWait =3,  PW = not active.
; Dst = 1, ^S^Q = flow ctrl off, IDwaitforID = 0sec, LoginCR = 2sec, MaxCR = 6,
;           PageCall = 16, Mode = PG1, GoWait =3,  PW = not active.
;
;        paging   dst  RespWait MxNAK min max
0E 00  06   05   00     07      01    01  07 ; NEW
0E 00  06   05   01     07      05    01  07 ; OLD
;
;                     |--------  Max  --------| |-----  Retry Wait  -----|
;        retries  dst  Busy NoAns NoDial NoLogin  Busy  NoAns NoDial NoLogin
0E 00  0E   06   00     07   03   03      07    00 08  00 20  00 20  00 10
0E 00  0E   06   01     07   03   03      07    00 08  00 20  00 20  00 10
;
; Modem Related Parameters
;
0E 00 02 07 28 ; Command Timeout (4 sec.)
0E 00 02 0A 28 ; Reset Wait (4 sec.)
0E 00 02 0B 28 ; InterCommand Wait (4 sec.)
; Hang up command string for Tapout dial modem
0E 00 0A FA 2B 2B 2B 2C 41 54 48 30 0D ; +++,ATH0<CR> disconnect
; Modem  Init. String  AT&F&M0&K0&H0&B1X3B1 ( US Robotics 33.6 & 56K )
0E 00  16 F8 41 54 26 46 26 4D 30 26 4B 30 26 48 30 26 42 31 58 33 42 31 0D ;
```

# OPARAM Programming/TNPP Networking Using Version 8TNPP8C3

The node addresses that the TNPP card will respond to for Inbound pages are set in the oparam.cds file. Unlike versions earlier than the 8TNPP8xx series, more than one node address may be selected as "our address". Each destination node address that the TNPP card will recognize as one of its receiving addresses must have an entry in the oparam list for the card. A destination address may be specified as routing to Central as a page, and/or route out to another node. A maximum of 32 node addresses may be specified.

The node address is specified as four pairs of hex digits, which is a 32-bit number. The two most significant bytes (high bytes) of the address currently are reserved; they should always be zeros. Besides the node address itself, you must specify the inertia count, ports to route the packet to, and ports to accept the address from. Central counts as a port. Any destination address that is to generate pages locally must be routed to Central.

The ports to route to are specified as a bit field made of two bytes. The ports that a given destination ID will be accepted from are specified in a similar fashion. The Multiport hardware supports up to eight ports, which TNPP considers ports one through eight. This numbering corresponds to the numbering used on the LEDs on the Multiport card. In order to set the route-to destinations for a port, you should do the following.

♦ **Setting route-to destinations:**

1. Determine all the ports this node ID will route to.
2. Using Table 35, add together the bit numbers of all routed-to ports for the node.
3. Convert the sum to a two-byte hexadecimal value.

When a network packet is received at a serial port, or sent to the card from Central, the destination node ID is looked up and the possible route-to ports determined. The bit number of the port that received the page is first cleared before the TNPP card attempts to route the packet, so that port will not be sent an "echo" of the packet.

Before routing is done that node's list of "accept-from" ports is checked. If the port the packet was received at is in the list, then the packet is accepted for routing. If it is not in the list, the packet will not normally be routed, and the reply to the sending node will be <CAN> or <ACK>, depending on the BAD_PORT setting in the receiving port's options field. BAD_PORT is part of the opcode "05" settings, the port programming opcode. Besides the BAD_PORT, setting the port programming allows you to specify the handling of packets not routed by the node table. It thus allows default routing on a per-port basis.

Please note that, the port receiving the packet need not have a bit set in the route-to field. As an example a simplex in link, such as for Network USA, will never have a packet sent to it and thus will never be routed to. For a terminal with just Network USA Satellite paging only Central, port zero, will ever have a page routed to it.

The route to mapping may be changed by destination remapping. This is covered in depth later.

There is a special case of routing that should be noted. Any accepted packet that is addressed to the terminal's physical node ID, i.e. the “us” setting, will always be routed to Central even if that node ID or routing is not set up in the node table programming.

Bit mapping is used to specify ports to route inbound packets to, as well as for specifying port to accept packets from.

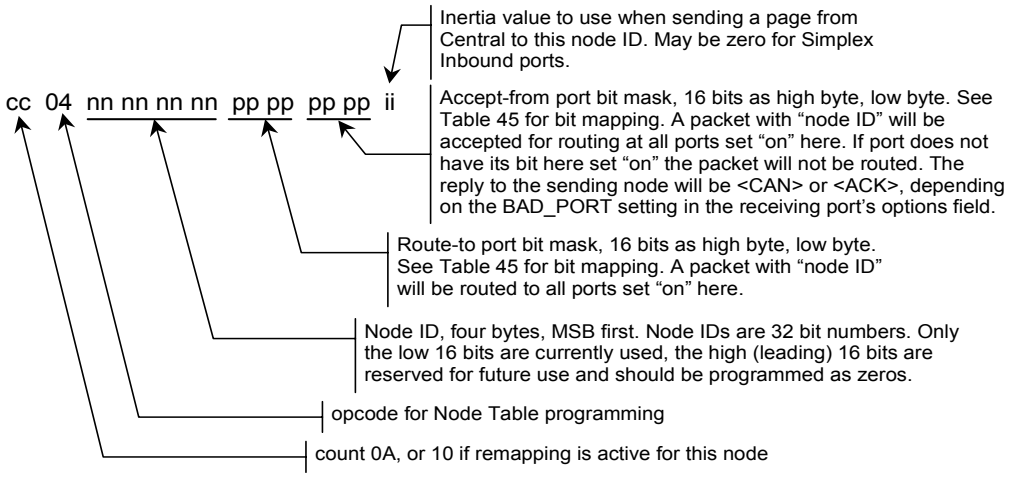
*Table 35: Ports versus Bit-mapping for Inbound Packets*

| Port | Port Number | Bit Number | Hex Value |
|---|---|---|---|
| Central | 0 | 1 | 0001H |
| Serial 1 | 1 | 2 | 0002H |
| Serial 2 | 2 | 3 | 0004H |
| Serial 3 | 3 | 4 | 0008H |
| Serial 4 | 4 | 5 | 0010H |
| Serial 5 | 5 | 6 | 0020H |
| Serial 6 | 6 | 7 | 0040H |
| Serial 7 | 7 | 8 | 0080H |
| Serial 8 | 8 | 9 | 0100H |

## Node Table Programming

The node table is a table in the network card that contains information on the nodes that the card is to recognize, and route data from and to. This table is loaded using oparam.cds entries, one record per node ID. If a node ID appears more than once in this programming, the later settings will override the earlier settings. This is done so that the node table may be adjusted using the “Set Oparam” ZlinkW command with small files containing just the records for the nodes to change.

Oparam format for node table programming is:


cc 04 nn nn nn nn pp pp pp pp ii
Inertia value to use when sending a page from Central to this node ID. May be zero for Simplex Inbound ports.
Accept-from port bit mask, 16 bits as high byte, low byte. See Table 45 for bit mapping. A packet with "node ID" will be accepted for routing at all ports set "on" here. If port does not have its bit here set "on" the packet will not be routed. The reply to the sending node will be <CAN> or <ACK>, depending on the BAD_PORT setting in the receiving port's options field.
Route-to port bit mask, 16 bits as high byte, low byte. See Table 45 for bit mapping. A packet with "node ID" will be routed to all ports set "on" here.
Node ID, four bytes, MSB first. Node IDs are 32 bit numbers. Only the low 16 bits are currently used, the high (leading) 16 bits are reserved for future use and should be programmed as zeros.
opcode for Node Table programming
count 0A, or 10 if remapping is active for this node

The next two parameters are optional. The are used to "re-map" one node address to another. Remapping effectively replaces the original node ID in a packet with the remap node ID.

| | |
|---|---|
| `pp pp` | Port bits for the port to do remapping for. If a port is not selected here then a packet with this node ID received at the port will not be remapped. |
| `rr rr rr rr` | Node ID to remap to. Same format as the original Node ID. |

## Port Programming

Each serial port that is to be active, sending and/or receiving pages, must be described in the oparam.cds file. There are several distinct opcodes for programming the port descriptions. Of these the "port mode" is the most important, as it sets the baud rate, type of TNPP link, and other properties of the link. The port programming parameters have a common lead-in format, which is:

| | |
|---|---|
| `aa` | NIU card address. |
| `uu` | Port ID, same as the Unit number on Multiport cards for IXO. This is 1 for serial port A, 2 for port B, and matches the "CHAN n" LED values. |
| `cc` | Argument count. |
| `pp` | The parameter code. |

The Port programming opcodes and their parameter lists follow:

| | |
|---|---|
| `cc` | Count 08 |
| `05` | The "set port modes" opcode |

`mm` Link operation mode for the port.

00 not configured
01 Simplex In (Satellite)
02 Simplex Out (Reserved, not supported)
03 Full Duplex (normal TNPP)
04 Blind Duplex (not recommended)

`bb` Baud Rate for the port.

00 300
01 1200 this is standard for duplex
02 9600
03 150
04 600
05 2400
06 4800

`oo oo` Two byte field for a variety of options. These are a set of bit values ORed together.

0010 BAD_PORT - treatment of “don't accept” packets. <ACK> “don't accept” packets received at ports not intended to receive some node ID.

If this bit is zero such packets will get <CAN> as a response.

0020 BAD_BLOCK - treatment of unknown block types. <ACK> packets containing unknown TNPP block types, otherwise <CAN> such packets.

0040 DO_CR - condition link for switched packet net. If set the port will send a <CR> after ever packet, packet response <ACK>, <NAK>, <CAN>, <RS>, or link test character <ENQ> <EOT>.

0080 END_ETB - last block in a packet formatting. If set end the last block in a packet with <ETB><ETX>, otherwise end it with just <ETX>.

0100 GATEWAY - handle Gateway Box type of blocking. Watch for multi-block packets where the <ETB> after each block has been “escaped” to <SUB>W. This is the setting for connecting to a “Gateway” box.

0200 BUFFERBOX - does not decrement inertia count; for pass-through buffering or multiple TNPP cards (8c0)

`dd dd` Unknown destination handling for this port. This tells the port what to do with a packet whose destination ID has not been programmed into the card. (i.e. - packets we do not know how to route using entries in the node table). The useful values are:

- 0000h Reject all unknown addresses, sending a <CAN> (cancel) to the connected node. Zetron terminals will log the sending or receiving of a <CAN>.
- 8000h Accept unknown addresses, sending an <ACK> to the other node. The packet will then discarded, as there is no routing information.
- 8001h through 81FFh Accept unknown addresses, sending an <ACK> to the other node. The low nine bits are used to determine which ports to route such packets to, and are meaningful only if the high bit is set on. The routing bits are identical in meaning as those in the node table port route mapping.

`cc` CRC mode used by this port.

- 00 Full binary CRC (default)
- 01 ASCII-Hex CRC (8c0 & later; also known as transparent CRC mode)

`cc` count 0B

`06` Set port timing parameters. Allows the adjustment of TNPP timing parameters away from the default TNPP specifications. Normally not used, may be useful with packet modems or dial-up. If used, all the timing parameters for a port must be specified.

Table 41 lists, in order as they are entered on a line in oparam.cds, the timing parameters. The various “T_xxxx” and “C_xxxx” labels are the names as use in the TNPP specification document, which gives a longer description of these parameters.

`07` Set port batching parameters. Reserved, currently this parameter should not be used.

*Table 36: TNPP Port Timing Parameters*

| Bytes | Default | Description |
|---|---|---|
| hh | 14 (2.0) | T_ICT Intercharacter timeout, 0.0 .. 25.5 seconds in 0.1 second increments. |
| hh hh | 00 3C (60) | T_IDLE Idle link timeout value, 0 .. 65,535 seconds. |
| hh | 0A (10) | T_NRE response to ENQ timeout value, 0..255 seconds in 1 second increments. |
| hh | 06 (6) | C_ENQ maximum ENQ retries before error logging, 0 .. 255 count. |
| hh | 0A (10) | T_NRI timeout when receiver idle, 0 .. 255 seconds. |
| hh | 3C (60) | T_NRB timeout when receiver busy, 0 .. 255 seconds. |
| hh | 06 (6) | C_RETRY maximum retries on sending a packet, 0 .. 255 count. |
| hh | 0A (10) | T_HOLD RS flag hold off time value, 0 .. 255 seconds. |
| hh | 18 (24) | C_HOLD max Re-transmissions in response to RS holdbacks, 0 .. 255 count. |

## Physical Node ID

The last oparam for the TNPP card uses the same opcode and general format as the older TNPP versions opcode “17”. This line serves two purposes. The first is to signal that all the TNPP oparams are done. The second is to set the physical node ID of the terminal. This is used as the source ID in all pages originating on this terminal. Only the “us” portion must be set, for this version of TNPP software our address must always be non-zero.

The “reject” and “block” fields are most useful for situations where a terminal is both receiving Network USA pages from a satellite downlink, and sending pages to the Network USA uplink. In this case, the page sent to Network USA from one port will later appear at the satellite downlink port. This situation can cause problems such as “echoing pages” unless special action is taken. This topic is covered in depth, along with node ID remapping, elsewhere.

| | |
|---|---|
| `cc` | count 0A |
| `17` | opcode for Physical Node programming. |
| `nn nn` | Physical Node ID, two bytes, MSB first. The physical node ID is only 16 bits. |
| `pp pp` | Reject port bit mask, 16 bits as high byte, low byte. See table above for bit mapping. A packet with this node's physical ID as its source will be rejected by all ports set “on” here, a <CAN> will be sent in response. |

| | |
|---|---|
| `pp pp` | Block port bit mask, 16 bits as high byte, low byte. See table above for bit mapping. A packet with this node's physical ID as its source will be blocked from being routed to any ports set “on” here, even if the packet would otherwise be routed to that port. |
| `00 00 00` | Three unused bytes |

## Sample OPARAM.CDS

```
;
;
; TNPP - card 13
;
;
;
;   Set the Port attributes
;
;                  full   1200  Unk Addrs
;                 duplex  baud    <CAN>     options
  0D 01   09   05    03    01     00 00      00 00   00 00  ; Port one
  0D 02   09   05    03    01     00 00      00 00   00 00  ; Port two
;
;   Set the known node addresses and their ports
;
;
;
;                                  Route   Accept
;                                   to      from   Use   From    To
;   Card  Cnt  Op     Node ID      Ports   Ports  Inertia
  0D 00   0A   04   00 00 01 00    00 03   00 05   02 ;   0,2    0,1
  0D 00   0A   04   00 00 01 01    00 07   00 07   03 ;   0,1,2  0,1,2
  0D 00   0A   04   00 00 01 02    00 06   00 07   03 ;   0,1,2  1,2
  0D 00   0A   04   00 00 01 03    00 02   00 04   03 ;   2      1
  0D 00   0A   04   00 00 01 05    00 06   00 06   03 ;   1,2    1,2
  0D 00   0A   04   00 00 00 01    00 07   00 07   03 ;   0,1,2  0,1,2
  0D 00   0A   04   00 00 DE 00    00 01   00 06   02 ;   1,2    0
;   Ports 0,1,2. 3 hops; Remap 0115 to DE00, if received at port 2
  0D 00   10   04   00 00 01 15    00 07   00 07   03  00 04   00 00 DE 00 ;
;
;   The next line should always be the last in the TNPP card settings
;   as it allows the TNPP tasks on the card to start doing something
;   useful, which assumes that the various node tables are set up.
;
; TNPP params:  Zetron: 0001 (us)
  0D 00   0A   17   00 01           00 00 00 00       10 00     04
```

## Enhanced Packet Routing

At times the packet routing needed exceeds the simple “accept from” and “route to” model. This includes terminals that serve to connect two existing networks where the same node ID has a different meaning on each network. Another case is terminals that both receive and send Network USA pages.

The node address remapping feature may be used to simply change the destination address on packets from selected ID/port combinations. Beyond that, it may be used to set up special routing instructions for those ID/port pairs.

The node addresses remapping uses two additional fields in a node routing entry to control remapping. The first field is used to specify the ports for which remapping is active. If the port's bit is set on then packets received at that port with the oparam line node ID as the packet destination node ID will be remapped. Remapping is done by replacing the packet's original destination address with the “remap to” address, which is the second field of the remapping fields.

If the new, remapped to, address is not in the node routing table then the “route to” bits of the original destination address will be used. If the new node address has an entry in the node table then that entry's “route to” bits will be used to route the remapped packet.

The overall effect of this simple remapping is that the Node IDs generated in Central are changed to the needed node addresses. A very simple example of this is shown in the following sample. There is only outgoing routing, all pages to this terminal are addressed to its primary node ID and use the implicit routing to Central for packets addresses to out primary node ID.

```
 0C 01   09   05   03  06  00 00  00 00   00 00    ; Duplex, 4800 BPS
;                                Route  Accept     Remap    Remap to
;                    node 0502    To     From      For Port  Dest address
 0C 00   10   04   00 00 05 00   00 02  00 01  08  00 01    00 00 10 00
 0C 00   10   04   00 00 05 01   00 02  00 01  08  00 01    00 00 33 33
 0C 00   10   04   00 00 05 02   00 02  00 01  08  00 01    00 00 02 FF
 0C 00   10   04   00 00 05 03   00 02  00 01  08  00 01    00 00 45 67
;              we are 1111
 0C 00   0A   17   11 11   00 00  00 00   00 00 00 ;
```

When remapping a node address, the routing information may be changed as well. If there is a node entry for address 100, and this entry will remap packets received at port two to 200, and there is no explicit node routing entry for 200, then the route-to bits for 100 will be used for all packets originally targeted to 100.

However, if there is an entry for 200 then its route-to bits will be used for all packets that were originally targeted at 200, as well as any packets that are remapped from 100 to 200. In the example shown in the following sample, destinations 0500 through 0503 will be remapped. Two of the new, remapped addresses have node table entries. Packets remapped to these two destinations, 3333 and 4567, will receive the routing information of the new destination. For the example these packets will be routed to ports 0 and 2, noting that the normal stripping of the source port's bit will occur.

```
 0C 01   09   05   03  01  00 00  00 00   00 00    ; Duplex, 1200 BPS
 0C 02   09   05   03  01  00 00  00 00   00 00    ; Duplex, 1200 BPS
;  First set up the remap node ID information
;                                Route  Accept     Remap    Remap to
;                    node 0502    To     From      For Port  Dest address
 0C 00   10   04   00 00 05 00   00 03  00 03  08  00 01    00 00 10 00
 0C 00   10   04   00 00 05 01   00 01  00 03  08  00 01    00 00 33 33
 0C 00   10   04   00 00 05 02   00 03  00 03  08  00 01    00 00 02 FF
 0C 00   10   04   00 00 05 03   00 01  00 03  08  00 01    00 00 45 67
;    Then the routing for two of the remapped addresses - send to port 2
 0C 00   0A   04   00 00 33 33   00 05  00 03  02
 0C 00   0A   04   00 00 45 67   00 05  00 03  02
;              we are 1111
 0C 00   0A   17   11 11   00 00  00 00   00 00 00 ;
```

An increasing number of terminals are both receiving Network USA paging, either from their own downlink dish or from some other node, and sending pages to Network USA's uplink node. This situation requires some care in setting up, as the pages sent to Network

USA will appear as part of the satellite downlink page stream. Usually the pages set to NetUSA are destined for the same regions as the terminal wishes to receive from the downlink, so simple routing control will not suffice.

There are two methods of handling this. The first is to use the remapping functions to change the destination addresses of the incoming Network USA pages to some other set of addresses. Then these addresses would have their routing set up so that they only go to Central, for local paging.

The second method is to use the “reject us” and “block us” fields that are part of the “17” opcode in the TNPP option parameters. These two fields allow control of packet routing based on the source address of the packets.

Both of these fields are bit-mapped port specifiers, similar to the “accept from” and “route to” fields for node routing. The “reject us” field allows you to specify ports that will reject any packet that originated at a node with the same primary node ID as this terminal. The “block us” field is used to specify which ports will not route packets with this terminal's source address.

Both of these fields are ignored when the packet is being originated by Central. Thus by setting the “block us” field to block routing to the port that send packets toward the Network USA uplink, any packet received at the downlink port that has our node ID as the source will not be routed back out towards NetUSA. This would be used when the terminal wishes to treat all NetUSA pages, even those of local origin, in the same fashion.

Alternatively the “reject us” bit could be set for the port connected to the satellite downlink. In this case no NetUSA page that was sent by this terminal will be processed and passed back to Central. Thus, these pages originally must have been paged locally if the terminal is to alert those pagers. This configuration can be used to give quicker service to locally originated NetUSA pages than to those that come from other nodes.

The following sample displays a very simple example of a terminal that routes pages to the Network USA uplink, and receives Network USA from a satellite dish downlink. Only a single destination node address is being used.

```
 0C 01   09   05   03  06  00 00  00 00   00 00 ; Duplex, to NetUSA UpLink
 0C 02   09   05   01  01  00 40  00 00   00 00 ; Simplex, NetUSA DownLink
;                                Route  Accept
;                     node 0502     To     From
 0C 00   0A   04   00 00 05 02   00 03  00 05  08  ;

;             we are 1111,  reject at port 2
 0C 00   0A   17   11 11   00 04  00 00   00 00 00 ;
```

# TAP Outdial OPARAM Codes

**For TAP outdial software version TAP8A0.**

## Per-destination Parameters

The per-destination parameters are a set of values that control the destination-specific behavior of the TAP outdial card.

*Table 37: TAP Outdial Per-destination Parameters*

| Meaning | cc | pp | qq ... |
|---|---|---|---|
| Batching control | 0B | 01 | This parameter is used to control the page-batching behavior.<br>Byte 1 = destination number. The ID number of the destination to set the batching control values for. This must be between zero and fifteen decimal, which is 00 to 0F hex.<br>Byte 2 = queue limit. Maximum number of queued pages allowed before attempting to call the destination. If the number of pages batched to this destination exceeds this parameter the destination will be called, even if the yellow time has not been reached. The default value is 255 decimal.<br>Bytes 3 & 4 = Yellow time. Yellow time, the time to hold lowest priority pages before attempting to call the destination. The time is in seconds, values from zero to 16000 are allowed. Default = 60 decimal (1 minute).<br>Bytes 5 & 6 = Orange time. Orange time, the time to hold lowest priority pages before forcing a call to the destination. The time is in seconds, values from zero to 16000 are allowed.<br>Default = 240 decimal (4 minutes).<br>Bytes 7 & 8 = Red time. Red time, must have paged by now. Pages held longer than the red time will be failed and posted as “no xmit”. The time is in seconds, values from zero to 16000 are allowed. Default = 900 decimal (15 minutes).<br>Bytes 9 & 10 = Scaling Factor. Priority scaling factor. The page's priority minus one, times the scaling factor, is subtracted from the yellow. Thus the higher the priority of a page the sooner it is eligible to be send out. Default = 30 decimal. |

Table 34: *TAP Outdial Per-destination Parameters (continued)*

| Meaning | cc | pp | qq ... |
|---|---|---|---|
| Dialing Control | 05 | 02 | This parameter is used to control the dialing behavior for a given destination. Currently the parameter is used to select the baud rate to call at and the time to wait for carrier.<br>Byte 1 = destination number. The ID number of the destination to set the Dialing and retry control values for. This must be between zero and fifteen decimal, which is 00 to 0F hex.<br>Byte 2 = baud rate. Baud rate used when calling this destination. The baud rate is coded as follows:<br>00 300 Baud<br>01 1200 Baud<br>02 9600 Baud<br>03 150 Baud - historical<br>04 600 Baud<br>05 2400 Baud<br>06 4800 Baud<br>These baud rate selection codes are the same as used for TNPP and the Multiport TAP input cards. Note that the modem must be capable of supporting the selected baud rate. The default is 300 baud.<br>Byte 3 = Data bits and parity setting Data and parity bits to use with this destination. These settings are coded as:<br>00 7 Data bits, Even parity.<br>01 7 Data bits, Odd parity.<br>02 8 Data bits, No parity.<br>The default is 7 Data bits, Even parity. This is also the value given in the TAP specification.<br>Byte 4 = seconds to wait for modem carrier. The number of seconds to wait for the modem's “connected” report, after finishing dialing. Any other possible response, such as “busy” or “no carrier”, are considered part of the “connected” reporting.<br>Note that the modem itself may, and usually does, have its own wait for connect time. Thus the modem may needed to be programmed for the desired wait period in an initialization string, as well as setting this parameter. The value ranges from 0 to 255 seconds, with values below 10 generally being unwise choices. The default is a 30-second wait for carrier. |

Table 34: *TAP Outdial Per-destination Parameters (continued)*

| Meaning | cc | pp | qq ... |
|---|---|---|---|
| Number to Dial | vv | 03 | Variable number between 3 and 43 (decimal count = 2B hex) This parameter simply sets the telephone number to dial for a given destination.<br>Byte 1 = destination number. The ID number of the destination to set the number to dial for. This must be between zero and fifteen decimal, which is 00 to 0F hex.<br>Bytes 2 through 42 = telephone number to dial. From zero to forty characters that represent the telephone number for this destination. |
| Paging Control | 06 | 05 | Controls behavior during the sending of an individual page.<br>Byte 1 = destination number. The ID number of the destination to set the session control values for. This must be between zero and fifteen decimal, which is 00 to 0F hex.<br>Byte 2 = Response wait. The number of seconds to wait for a response to the current page being entered. The response will indicate the acceptance or rejection of the page. This is a value between zero and 255 seconds, with zero being an unwise choice.<br>Byte 3 = Maximum number of NAKs per page. The number of times a given block will be retransmitted in response to NAK responses. The NAK response indicates that the block was received with data transmission errors, and should be resent.<br>Please note that, a successful block transmission clears the NAK count. This means that a transmission error for a block will not impact the retry counts for a later block. The default is five retries per NAKed block.<br>Byte 4 = Minimum number of characters in ID. A subscriber ID number formatting control parameter. Some types of terminals require at least a minimum number of characters in the subscriber ID, this parameter allows the minimum width to be set.<br>The subscriber will have leading zeros eliminated until it is no longer than this value, or a non-zero is reached.<br>The subscriber number will always have at least this many characters in it, being padded out with leading zeros if needed. Default = 0.<br>Byte 5 = Maximum number of characters in ID. A subscriber ID number formatting control parameter. Some TAP input devices will not accept subscriber ID values with more than a certain number of digits, even if the leading digits are zeros. This parameter is used to restrict the maximum number of digits that will sent as a subscriber ID. If the ID would be longer than the maximum, then leftmost digits will discarded to fit.<br>Please note that some TAP input implementations require a fixed length subscriber ID. This can be done by setting the minimum and maximum number of digits to the same value. This sets how many digits the called system requires. The default setting is 0. This causes trimming of leading zeros. |

Table 34: *TAP Outdial Per-destination Parameters (continued)*

| Meaning | cc | pp | qq ... |
|---|---|---|---|
| Retry Control | 0E | 06 | There are a variety of reasons that an attempt to call a destination may fail. The Outdial TAP card will retry calls to a destination, if so desired. Obviously getting a busy signal should cause a retry to that number. These settings control the retry behavior for each destination. There is a maximum number of retries and a time between retries for each of the failure modes.<br>Byte 1 = destination number. The ID number of the destination to set the session control values for. This must be between zero and fifteen decimal, which is 00 to 0F hex.<br>Byte 2 = Maximum BUSY retry count. The maximum number of times a BUSY may be detected, without a successful connect, before TAP outdial gives up. The default is 20 (decimal) retries.<br>Byte 3 = Maximum NO ANSWER retry count. The maximum number of times a NO ANSWER condition may be detected, without a successful connect, before TAP outdial gives up. The default is five retries.<br>Byte 4 = Maximum NO DIALTONE retry count. The maximum number of times a NO DIALTONE condition may be detected, without a successful connect, before TAP outdial gives up. The default is five retries.<br>Byte 5 = Maximum NO LOGIN retry count. The maximum number of times a NO LOGIN condition may be detected, without a successful connect, before TAP outdial gives up. The default is five retries.<br>Bytes 6 and 7 = BUSY Retry hold-off time. The number of seconds that must elapse after a BUSY response before that destination will be tried again. The default is a 10 second hold off.<br>Bytes 8 and 9 = NO ANSWER Retry hold-off time. The amount of time that must elapse after a NO ANSWER response before that destination will be tried again. The default is a 30-second hold-off.<br>Bytes 10 and 11 = NO DIALTONE Retry hold-off time. The amount of time that must elapse after a NO DIALTONE response before that destination will be tried again. The default is a 30-second hold-off.<br>Bytes 12 and 13 = NO LOGIN Retry hold-off time. The amount of time that must elapse after a NO LOGIN response before that destination will be tried again. The default is a 30-second hold-off. |

Table 34: *TAP Outdial Per-destination Parameters (continued)*

| Meaning | cc | pp | qq ... |
|---|---|---|---|
| Session control | vv | 04 | Variable, 09 through 10 hex. This is a set of values that have to do with determination the behavior of a TAP session, after connecting to a destination. Some control login behavior, while others apply during the sending of pages after login.<br>Byte 1 = destination number. The ID number of the destination to set the session control values for. This must be between zero and fifteen decimal, which is 00 to 0F hex.<br>Byte 2 = Flow Control If zero, then Flow control is not active. Otherwise it is the maximum number of seconds to wait for an X-OFF (<DC3>) to be cleared with an X-ON (<DC1>). If, after receiving an X-OFF, an X-ON is not seen within this time then the Outdial TAP card will resume data transmission, assuming that the X-ON was missed. The default is no flow control.<br>Byte 3 = ID Wait. Seconds to wait for target to auto-send the "ID=" string, after modem connect. If the string after this number of seconds has elapsed the TAP outdial card will start sending carriage returns. The default value is zero.<br>Byte 4 = Login <CR> Wait. Seconds to wait between carriage transmissions for the "ID=" to be sent by the called terminal. The default value is two seconds.<br>Byte 5 = Maximum Login <CR> sends. How many <CR> attempts to do while waiting for the called terminal to send the "ID=" string. If not seen after this number of carriage returns have been transmitted then the call will fail. The default is six <CR> transmissions.<br>Byte 6 = Maximum pages sent per session. How many page attempts to do during any single call or log-in / log-out session. Some systems can only handle a limited number of TAP transactions during a session. This parameter can be used to satisfy such requirements. It could also be used to restrict the length of a session on a particular destination. The default value is 255 pages per session.<br>Byte 7 = TAP mode 0 = Reserved, do not use<br>1 = PG1 (default) |

Table 31: *TAP Outdial Per-destination Parameters (continued)*

| Meaning | cc | pp | qq ... |
|---|---|---|---|
| Session control (continued) | vv | 04 | Byte 8 = Seconds to wait for message go-ahead. The number of seconds to wait for the "paging go ahead" from the called system, after logging in. Logging in is the set of actions starting with sending Carriage Return to get the "ID=", through receiving an acknowledge of the paging mode. On many implementations of TAP there is a noticeable delay between logging in and the paging go ahead. The default value is 10 seconds.<br>Bytes 9 through 15 Optional Login Password An optional field of up to 6 characters. Some system will have a password set that a caller must enter before they can send TAP pages to the system.<br>Some implementations of TAP required the password to always be given, and in many cases that it be exactly six characters in length. On these systems the password would often be set to "000000", the nearest they can come to not requiring a password. The default is no active password. |
| 10-digit area code | 05 | 0D | byte 1 = Dialing destination<br>byte 2 = 3 + first digit of area code<br>byte 3 = 3 + second digit of area code<br>byte 4 = 3 + third digit of area code<br>The second digit of each hexadecimal pair equals a digit of the area code. For example, the area code 425 would be entered as: 34 32 35 |

## Modem-related Parameters

These are set once for the entire outdial TAP card, and apply to all destinations. All have a maximum value of 255, or 25.5 seconds.

*Table 38: Modem Related TAP Parameters*

| Meaning | cc | pp | qq ... |
|---|---|---|---|
| Command Timeout | 02 | 07 | Byte 1 = Command Reply Timeout. Modem command reply timeout, 0.1 sec units. How long to wait for the modem to reply to a command. This is the maximum time any non-dialing command should take to complete. Default = 10 decimal (1 second). |
| Command Wait | 02 | 0B | Byte 1 = Inter-Command Wait. General command guard time, 0.1 second units. After sending any command except the reset command (i.e. ATZ) to the modem wait this long before sending another command. This value only takes effect if there is no expected response string for the command sequence. The default value is 2 seconds. |
| DTR Wait | 02 | 08 | Byte 1 = DTR Wait. DTR transition guard time, 0.1 second units. How long to wait after changing DTR before talking to the modem again. The default value is 1 second. |
| Guard Time | 02 | 09 | Byte 1 = Guard Time. Command escape sequence guard time 0.1 sec. Sets the “dead” time bracketing the sending of the “enter command mode” string to the modem. The default value is 1 second. |
| Reset Wait | 02 | 0A | Byte 1 = Reset Wait. Reset command guard time, 0.1 second units After sending the modem the reset command (i.e. ATZ) wait this long before sending another command. The default value is 2 seconds. |

Table 35: *Modem Related TAP Parameters (continued)*

| Meaning | cc | pp | qq ... |
|---|---|---|---|
| Special character mappings | 05 | 0C | This controls the screening and remapping of any characters outside of the TAP legal set. Without this new parameter being programmed the outdial TAP card will filter any illegal message characters to safe values.<br>Byte 1 = Destination number. The destination number to apply the screening/remapping on.<br>Byte 2 = Replacement character for high bit characters. Character used to replace any characters with their high bit set. TAP only uses seven bit data, so any "8 bit high" characters must be mapped to something else. If this parameter is set to a value less than 80h then that value will be used to replace any 8-bit-high character. If the parameter value is greater than 7Fh then the high bit will be set to zero. The default is 3Fh, which replaces any high-bit-set byte to a question mark.<br>Byte 3 = Replacement character for carriage return. Character used to replace any carriage returns in the message string. Default is 20h, a blank.<br>Byte 4 = Replacement character for TAP reserved characters. Character used to replace any TAP reserved characters in the message string. Default is 3Fh, a question mark. |

## Modem Programming Strings

The various modem programming strings are all programmed with lines of the form '`aa 00 cc pp .. .. .. .. ..`" where"`aa`' is the card number (address), "`pp`" is from the Table 39, and "`cc`" is the number of bytes which is one plus the number of characters in the string being programmed.

Note that the strings must be set as the hex value for each individual character; refer to the ASCII table in Appendix B to convert the letters.

Example:

```
09 00  05  FC  41 54 5A 0D    ; Card 9, TapOut reset string: ATZ<CR>
```

*Table 39: Modem Programming Strings*

| Parameter Code “pp” | Meaning | Default (in quotes) “empty” if no default |
|---|---|---|
| FF | The string used to enter a command to the modem. | “<CR>” |
| FE | The null command string. | “AT<CR>” |
| FD | The response to the null command. | “OK” |
| FC | The string used to reset the modem. | “ATZ<CR>” |
| FB | The expected response from the reset string. | “OK<CR>” |
| FA | The string used to do a disconnect. | empty |
| F9 | The expected response to the disconnect string. | “OK<CR>” |
| F8 | First initialization string. | “ATV1Q0X3E1<CR>” |
| F7 | Expected response to first initialization string. | “OK” |
| F6 | Second initialization string. | empty |
| F5 | Expected response to second initialization string. | “OK” |
| F4 | Third initialization string. | empty |
| F3 | Expected response to third initialization string. | “OK” |
| F2 | The first dialing string. | empty |
| F1 | Expected response to first dialing string. | empty |
| F0 | The second dialing string. | “ATDT” |
| EF | Expected response to second dialing string. | empty |
| EE | The final string used in dialing out. | “<CR>” |
| ED | Expected response to third dialing string. | empty |
| EC | Modem's reply to a bad command. | “ERROR<CR>” |
| EB | Modem response to busy tone. | “BUSY” |
| EA | Modem response to absence of dial tone. | “NO DIALTONE<CR>” |
| E9 | Modem response to no connect or carrier loss. | “NO CARRIER<CR>” |
| E8 | Modem response to 300 Baud connect. | “CONNECT<CR>” |
| E7 | Modem response to 600 Baud connect. | “CONNECT 600<CR>” |
| E6 | Modem response to 1200 Baud connect. | “CONNECT 1200<CR>” |
| E5 | Modem response to 2400 Baud connect. | “CONNECT 2400<CR>” |
| E4 | Modem response to 4800 Baud connect. | “CONNECT 4800<CR>” |
| E3 | Modem response to 9600 Baud connect. | “CONNECT 9600<CR>” |

Refer to the section on *Multiport for TNPP and TAP Outdial* on page 133, for a discussion of the use of the parameters and strings, and samples listed in Table 39.

# The ".CUS" Files

The various ".CUS" files contain one or more lines of command text. A command line consists of a command keyword followed by one or more parameters, depending on the command. Commands and their parameters may be in upper or lower case, in this document commands will be in upper case letters.

Blank lines are ignored, as is any text after a semi-colon (";"). This allows the commenting and documentation of a file by visually splitting the text into blocks of related operations and annotating the various command settings.

The processing of these files will log any errors encountered. An error will cause the logging, or displaying if being done from ZlinkW, of a function name, file name, and line number in the file. This is followed by the error description and the beginning of the line causing the error. An error may cause just the skipping of a bad parameter, or the entire line may be bypassed. In any case, the entire file will be processed, and the error will not cause the changing of the associated function from its current condition. Error conditions and descriptions include:

| | |
|---|---|
| `Command not known` | The first word found is not a valid command. |
| `Argument needed` | The command needs more parameters than were found on the command line. |
| `Bad argument` | The value of a parameter was illegal. This includes using a word besides the valid keywords for that command, choosing a value that is out of range, or trying to select trunk cards that are not installed or functional. |
| `Option not installed` | The command keyword controls an option that is not installed on this terminal. |

## Commands Found in OPTIONS.CUS

The options.cus file is used to set various system-wide options.

### #Enable

If the terminal has PageSaver installed the #Enable command will determine if the "#" key on a DTMF telephone will affect the playback of a subscriber's saved voice messages. Normally the "#" is active, and if a subscriber presses it during the playback of messages in their mailbox, they will abort the playing of the current message and cause the paging terminal to hang up. This can be a problem when it is difficult to balance the line hybrids for all incoming calls, and a caller has recorded a "#" tone at the end of his message, as often happens with callers using mobile phones. Under these conditions the playback may result in the "falsing" of the receipt of a "#" from the subscriber, and hang up on him. Setting #Enable to off will disable the "#" key during message playback.

```
#ENABLE            ON  ; Allow # key to abort the call.
#ENABLE           OFF  ; The # key will have no effect on
                       ; voice message playback
```

### BadNumber

The BadNumber command directs all calls placed to bad IDs to a particular number - usually to play an explanatory announcement or direct the call to an operator. The BadNumber command sends a page to the specified ID when the number that is received:

- is within the valid number blocks
- (and) has no subscriber database record not even Status I or Status U

The correct format for the BadNumber command line in options.cus is:

```
BadNumber  <ID-to-execute-when-bad-number-occurs>
```

This command can be used to forward bad numbers (for example, dial click failures) to an operator or a recorded message. It can also be used to play a different prompt for numbers with Status I and Status U, versus numbers that are not in the database.

When the BadNumber command is executed, both ID's are logged. However, only the one that is actually used gets call counted.

### BillingDelay

This feature allows you to set the billing delay hold time for each trunk. The delay hold time is the minimum length of time a call must last (be offhook) to be considered valid for billing purposes. With alert-only pagers, the 2000 Series will not play the page accept prompt until the call length equals the billing delay hold time.

The format for the line is as follows:

```
BillingDelay   Default   ; old way things worked (2 second delay)
BillingDelay   Off       ; no hold (zero second delay)
BillingDelay   0         ; no hold (zero second delay)
BillingDelay   <number>  ; delay time is <number> seconds
```

### BlockIfSecurity

BlockIfSecurity set to PHONE means the security code blocks only telephone calls, not any other input source, which is how it has worked in the past. When set to ALL it means that a subscriber with a security code can only be paged from telephone input.

### BypassPrio

The BypassPrio command is associated with the above Load Management features. It lets you establish a priority level above which the Load Management limit is bypassed.

```
BYPASSPRIO  4
Values: 1 to 4, NEXT, and BREAK
Default if missing: 4
```

### ClientName

The ClientName command is used to set the site name that is logged whenever the paging terminal is rebooted; this string is also shown by the ZlinkW “ver” command. Blanks and tabs following the command ClientName are skipped until a non-blank character is found, and then it and all following characters up to a total of 40 characters or the end of the line are used for the client name. Please note that any blanks in this area will be included.

### DisplayTime

The DisplayTime command lets you append the current time to the end of each display message. This applies to all display pagers on your system. Either everyone will get the time added to their display pages (if ON), or none will (if OFF). The default is OFF. If ON, a timestamp of the form “ hhmm” is added to the display message; that is, a space, the hours in 24-hour format, and the minutes. The time is the time the page came into the system, not the time it went out on the air (these times may be different on a busy system). For example:

```
DISPLAYTIME ON
```

With the feature ON, if someone entered “555-1212” to a pager, the display would show “555-1212 1529” if the page came in at 3:29pm.

The DisplayTime timestamp will not be added if the length of the resulting whole message (the entered display message plus the timestamp) is longer than the pager's display limit as set in the database.

With the release of version 310j0, time stamping can be enabled at the subscriber level, even when the system is set to DisplayTime OFF in options.cus. To enable time stamping for any subscriber, set the Display Limit field (in ZbaseW) to:

```
Tnn
```

“T” sets the timestamp to ON. “nn” is the display limit in decimal digits.

**Note** If the paging terminal's time is incorrect, use the ZlinkW “time” command to set it correctly (see *Remote Maintenance* on page 307).

### DynamicGroups

The Dynamic Groups feature allows a Series 2000 paging terminal to page a group of pagers whose membership is not defined by means of the ZbaseW database program. A CAD system, or other TAP input device, defines the group membership for a group call that is entered into the 2000 paging terminal.

The Dynamic Groups feature is enabled or disabled by the DynamicGroups command in the options.cus file. The format is:

```
DynamicGroups <card><unit> <pilot-number-1>...<pilot-number-16>
```

Where: <card> = the card number (1 through 31, in base 10) of the card (typically multiport) that the CAD connects to
<unit> = the unit designation (A through H) of the unit on the card that CAD is connected to
<pilot-number-x> = is one of the Status G pilot numbers that the consoles enter the group call on

The default condition is that the command DynamicGroups is found on a line by itself. This disables the feature. The following example sets the CAD port as 8A and designates two dynamic group pilot numbers; 000-0001and 000-0002.

```
DynamicGroups 8A 1 2
```

**Note** The pilot numbers used do not have to be consecutive.

## FastDTMF

The FastDTMF command is used in conjunction with the Notify Voice-or-Display feature (requires 6F0 or later trunk code). The format is:

```
FastDTMF <ms_of_post_0_delay>  OneYes
                               OneNo
```

The default is:

```
FastDTMF 2000 OneYes
```

New systems may wish to use:

```
FastDTMF 0 OneNo
```

The delay value is how long, in milliseconds, the trunk card will wait after a 0 is entered to see if a display message starting with 0 is being entered (during the voice prompt), as opposed to an owner's access being initiated. Particularly on in-plant installations a message starting in 0 is possible. Note that a system with 0 delay cannot have a Security Code that starts with a 0, for a subscriber with owner's access, the 0 into the prompt will always be taken to be the Security Code, not the owner's access.

The OneYes says that the old behavior of a DTMF "1" into the prompt to leave a display message is supported - this is so that a sysop can switch to Notify Or without confusing or upsetting their existing customers. If no one wants this feature, OneNo should be used - thus allowing the quick entry of a display message starting with "1".

## FaultON

Starting with version 310K8 of Zpage, several parameters were added to support the triggering of the Fault Relay and, in redundant systems, cause the switching to the standby system to occur. These parameters are set in the options.cus file.

The parameters used to modify the FaultON command are: CR_Dead, CR_NotRdy, SDB_Probes, and T1_LOS. There are no values or other entries to modify these parameters. If the parameter is present in the options.cus file then monitoring for the fault condition is enabled. If the parameter is absent from the options.cus file then the fault

condition is disabled. The default condition for the options.cus file is for FaultON to be absent.

```
FaultON CR_Dead CR_NotRdy SDB_Probes T1_LOS
```

#### CR_DEAD

The paging terminal detects that a card has become unresponsive. Zpage will indicate that a card is DEAD when the “liu” command is entered at the plus prompt.

#### CR_NOTRDY

The paging terminal detects that a card was not loaded with the correct Image code. When the “cards” command is entered at the plus prompt, Zpage will indicate the card's Not Ready status by returning the string “UP-A”.

#### SDB_PROBES

The system detects that Zpage has posted “sdb probes” in the system log files. This message indicates that Zpage could not find a subscriber in the Subscriber Database. This could be a database error or data corruption. If the Call Counts feature is not in use, this command does not need to be set.

#### T1_LOS

The paging terminal detects that the T1 interface has lost the T1 signal (Loss Of Signal). Whenever there is an LOS detected, a Yellow Alarm is issued and the system is switched over to the Standby equipment.

In addition to these new parameters, the command FaultOff has been added to allow clearing of the Fault Relay. When any of the conditions described here occur, wait until the condition is cleared and then enter “FaultOff” at the plus prompt to reset the Fault Relay.

### FileProbes

The FileProbes setting reports when excessive seeking (hash overflow) is occurring in Call Counts (CC) or Subscriber DataBase (SDB) binary hashed files. Useful to see if a Full Rebuild or Call Counts Rollover needs to be done. Also, it can be used to turn off call counting via “FileProbes CC 0”, sometimes helpful on extremely busy systems (that do not use the call counts). The default is:

```
FileProbes CC 20 SDB 20
```

The FollowForward and BlockIfSecurity settings control the difference between telephone and non-phone (Group call, Alpha input, etc.) calls.

### FollowForward

FollowForward controls whether an internal forward is followed or ignored for non-phone inputs. If set to PHONE, it acts like previous versions have acted, where non-phone calls

ignore the forwarding. When set to ALL, it means TAP, Group call, and other non-phone inputs are forwarded just like a telephone call.

### GroupNote

The GroupNote command affects what appears on display pagers that are paged as part of a Group that is in Notify mode. If ON, the pagers will display the number called (the group pilot number) followed by the usual PageNote display. If OFF, the pagers will display only the normal Notify PageNote display. The default if missing is OFF, but we set it ON as shipped from the factory because most people prefer it that way.

### Installations

The Installations command specifies the number of ZbaseW (office computer) installations that access this terminal. This is used to support multiple agent access.

```
INSTALLATIONS      1      ; only one office site
INSTALLATIONS      3      ; three active office sites
```

When using the PageSaver Notify mode the number of notifications and the interval between them may be set with the Reminders and ReminderTime commands.

### LocalPort

The LocalPort command lets you adjust the serial port baud rate if you have the Local Connect option. Be careful with this - if the ZlinkW baud rate on your computer does not match, you will not be able to get into the terminal. (You can still get in via the modem port, so it is not fatal). The allowed values are 300, 600, 1200, 2400, 4800, and 9600.

```
LOCALPORT   2400      ; only 2400 baud wanted for local connect
```

### LogDisplay

The LogDisplay command sets the maximum number of display message characters that are shown in the logs. The default is 29, which is the maximum that the prior software displayed.

The correct format for the LogDisplay command line is:

```
LogDisplay  <number>
```

Where the <number> is any whole number value between 0 and 1000 (anything larger than 1000 would be impractical).

Examples:

```
LogDisplay  1000   ; as big as possible (from TNPP)
LogDisplay  0      ; privacy is desired
LogDisplay  29     ; default value (no change)
LogDisplay  80     ; default for "nextline" special
```

### MailPurge

The MailPurge command, when enabled, purges “stale mail”. It checks mailboxes to see if they contain only expired messages. Any such mailbox will be deleted, just as if the owner had called in to it. A mailbox that contains any message that is not expired will not be deleted. The purpose is to prevent the paging terminal's disk space from being consumed by unused owners (mailbox) files.

This feature is enabled by selecting a non-zero value for the MailPurge setting. This value represents the number of hours to wait before checking a mailbox for “freshness”. In other words, a mailbox must not have been updated by either a call to the subscriber, or the subscriber doing owner access, for at least the selected number of hours before it becomes a candidate for freshness checking. This interval reduces useless opening and closing of mailboxes, which load down the system.

The interval should be set to the typical or most frequent retention time used on that system. Setting it to a shorter interval will accomplish little to nothing, except to waste system resources. Setting it many times longer may reduce the efficiency of the mailbox purging. The interval is limited to the range of zero to 255 hours, matching the ZbaseW retention time range. Please note that selecting zero as the interval disables the stale mailbox checking.

The mailbox testing and purging will not be done if the system has less than 10,000 bytes of free heap. This limit is used as a rough estimate of system loading; a busy system will not have much free heap and does not need to spend resources doing the mailbox purging. On busy systems, this means that the stale mailbox cleanup will only be done during off-hours. When the feature is enabled and able to run it will check up to five mailboxes per minute.

```
MailPurge       OFF     ; do not scan for stale mailboxes
MailPurge       0       ; do not scan for stale mailboxes
MailPurge       nnn     ; Check mailboxes that have not been accessed
                        ; within the last 'nnn' hours.  Delete any
                        ; such mailbox that contains only expired
                        ; messages.
MailPurge       48      ; Current factory default for new terminals.
```

### MailStart

The MailStart command determines the order in which mailbox messages will play out to the caller. The default is OLDEST, where the oldest messages are played out first (first in first out order); or you can set it to NEWEST, where the newest messages are played out first (last in first out order). The default is OLDEST to encourage people to clean up their mailboxes (because if they do not, they will get tired of hearing the same first message(s) again and again).

### MaxOwners

The MaxOwners command determines the maximum number of actions that may be done within owners access mode. This allows a system operator to control how long (how many different actions) that subscribers can do in the PageSaver menus, before being “kicked off”. Note that the “Help” (DTMF “0”) and “Verify Current Mode (DTMF “7”) operations

count as "half" operations. This means that an owner could do twice as many of functions "0" and/or "7" as any other owners menu actions.

The default number of operations remains at two, just as with the older hardwired code. However, our current factory default is to set it to four.

```
Maxowners       nnn     ; Set the maximum number of owner access
                        ; operations to "nnn".  The value must be
                        ; between 1 and 255.
```

### MaxRecycle

The MaxRecycle command allows callers to "recycle" a call, letting them enter multiple telephone numbers with a single telephone call. By entering a DTMF "#" into the "Thank You" prompt at the end of a call, or into the main Owners Menu prompt, the caller will be given the "Enter Pager Number" prompt. At this point the call can be considered as being to an End To End line, even though the call may be on a DID line. If the caller enters an invalid telephone number the invalid number prompt will be played. At that point the caller may enter a "#" in order to re-enter the subscriber number.

The caller may continue to recycle the call after placing each page, or performing owner access operations, until the system wide recycle limit set by MaxRecycle is reached. Each page, owner access, or invalid number counts as one call recycle action. Thus, there is no way to stay in recycle mode indefinitely. The caller will always end up being disconnected.

At the end of a call that has performed a total of two or more operations using call recycling, an extra line will be posted in the log. This line will have the original number called as its telephone number, and will report the number of operations performed. The status field will be filled in as "call done".

When call recycling is enabled, the system operator may control which subscribers may do call recycling. This is done by only giving "thank you" prompts to those subscribers who are to be allowed to have call recycling. If MaxRecycle is set OFF then enabling the "thank you" prompt just controls the playing of that prompt.

During call recycling, all operations after the original, start of call inherit some attributes of the original call. The thank-you prompt status and the priority of the original subscriber ID will be applied to all further subscriber IDs entered. This insures that a caller who has call recycling enabled will be able to continue to recycle, even though some subscriber IDs he enters do not normally get the thank-you prompt.

Call recycling requires that the system have a "Thank You" prompt. Thus, it will not work on systems without a voice controller card.

When using recycling with DID lines a DID overdial number should be set up to control the number of overdial digits expected on any recycle (2nd through Nth) subscriber number entry. If you do not have the DID overdial feature programmed for a trunk, and attempt call recycling on that trunk, the operation will fail. If the trunk is already using the DID overdial feature for some other purpose, then call recycling will be forced to use that number of feed digits. Normally, this should not be a problem as DID overdial is usually

used to replace an 800 number into End-to-End lines. On End-to-End lines, the number of subscriber digits expected is the same for any pass through the call-recycling loop.

```
MaxRecycle      OFF    ; do not allow call recycling (default)
MaxRecycle      0      ; do not allow call recycling
                       ; The default value is OFF
MaxRecycle      1      ; do not allow call recycling (only 1 call)
MaxRecycle      nnn    ; Allow a caller to perform up 'nnn'-1
                       ; recycle operations.  This means that
                       ; a caller may place 'nnn' pages.
                       ; nnn = 2-255.
```

### MaxTalkback

On systems with the Talkback option, you can set the maximum number of Talkback calls that can be queued up waiting for their turn on the air. This is similar to Load Management settings, already discussed.

```
MAXTALKBACK 5
CHANNEL 2
MAXTALKBACK 2
CHANNEL 3 4
```

Values: 1 to 250; 0, OFF, NONE, or NO to disable; or DEFAULT
Default if missing or DEFAULT: 2

### MinimumVoice / MinimumData / MinimumPrompt

The MinimumVoice, MinimumData, and MinimumPrompt commands set thresholds for the amount to consider “empty”. The number is the seconds of voice for MinimumVoice and MinimumPrompt; number of digits for MinimumData. These parameters are especially useful for preventing people from recording custom or system prompts that are too short, and/or to make the meaning of Page With Empty Message in the database more strict. Times are +- 1 sec. The default if missing is OFF or 0 (no threshold); but we factory-set it as follows so that the Page With Empty Message feature works better, and so that system operators do not have trouble with people recording too-short custom prompts:

```
MINIMUMVOICE   2
MINIMUMDATA    1
MINIMUMPROMPT  2
```

Values allowed are 0 through 15, or OFF (OFF is same as 0)

**Note** In order for MinimumVoice and MinimumData to work, the subscriber must have the “Send Empty Message” field in the subscriber database set to “NO”. This field is found in ZbaseW when specifying the capcode for a subscriber.

### ModemBaud

The ModemBaud command was added in version 310j0 to support the fact that many modem cards now have autobaud capabilities. The autobaud feature will support baud rates of 300, 1200, 2400, 4800, 9600, and 14400. options.cus sets the maximum communication speed of the modem card (default is 1200 baud). The format for the options.cus command line is:

```
modembaud nnnn
```

where nnnn is the maximum modem speed (any of those listed above).

For communications at 300 baud, the speed should be set to 300 in the above command. Otherwise, the modem may not reliably autobaud all the way down to 300 baud.

### ModeInit

The ModemInit command is used to change the remote access ZlinkW port's modem settings. This is most useful for changing the number of rings before answer, or when CCITT modem tones are desired.

Great care must be take when modifying the modem initialization string, as an error could render the remote access port non-functional. The string or strings specified with the ModemInit commands completely replace the default modem initialization string.

More than one line of initialization strings may be sent to the modem by terminating all but the last line with a blank followed by a back-slash ("\"). The last line must not end with a back-slash. Each line will be sent to the modem in the order of the ModemInit statements. Remember that no single initialization string may be longer than 38 characters.

```
MODEMINIT          string

MODEMINIT          AT X4 V1
MODEMINIT          AT S7=4
```

For communications at 9600 or 14400 baud, the &Q0 command needs to be included in the ModemInit string in options.cus. The &Q0 command disables data compression and error correction functions. (ZlinkW performs error correction by default. Moreover, compression delays the ZlinkW protocol ACKs.) Below is an example of the &Q0 command for ModemInit:

```
modeminit  AT S0=2 S7=30 S9=6 S10=14 X4 V1 &Q0
```

See your modem owner's manual for specific modem commands, their format, and applications.

For 9600 baud and faster modems, the system log may indicate the computer-to-modem speed, rather than the modem-to-modem speed. The log reports whatever is in the connect string. However, the currently shipping US Robotics Sportster modem has been set with the &B0 command which reports the modem-to-modem speed in the connect string.

If your maintenance modem is a Hayes 1200, the ModemInit string requires an X4 result code command (default is X0 = 300 baud) to enable extended result codes for autobauding. Newer modems default to X4 unless it is expressly overwritten.

**Note** Any command in the ModemInit string that the modem does not understand could cause an error, which could return some settings to the default values. If you encounter an error, please check that the X4 result code is still active.

### MTTMk7VorD

This command only effects subscribers that have been assigned Multitone Mk7 pagers set for Mode 6 (display paging) that also have the voice time parameter set to something larger than zero.

```
MTTMk7VorD    Yes  ;If set to Yes, then a Multitone Mk7 page (set to
                   ;Mode 6 with a voice time greater than zero) is
                   ;enabled for Voice or Display paging.

MTTMk7VorD    No   ;If set to No, then a Multitone Mk7 pager (set to
                   ;Mode 6 with a voice time greater than zero) behaves
                   ;as it did in earlier versions of the S2000 paging
                   ;terminal software. (Prior to ver 310KE)
```

The MTTMk7VorD command being absent from the options.cus file is the same as it being set to “No”.

### Notify

The Notify command controls some details of Notify mode operations. The format is:

```
Notify Old   IdNone
          Or IdGroup
              IdAll
```

The default, and formerly the only, method of operation for notify mode is:

```
Notify Old IdNone
```

New systems may wish to use:

```
Notify Or IdAll
```

The “Old” keyword says that Notify mode will take a voice message only (unless you know about the “secret” 1 overdial). The “Or” keyword says that Notify mode will take either a spoken voice message OR an overdialed display message (requires 6F0 or later trunk code).

The “Id...” keywords control whether the called telephone number is prefixed to the notification message. Thus IdNone never causes a called telephone number to be prefixed. The IdGroup causes the called telephone number to be prefixed if the called number is a group number - that is identical to the already existing “GroupNote Yes” OPTIONS.CUS line. The IdAll causes the Id number to always be prefixed to the notification message; this can be useful on a network of paging terminals where some subscribers have phone numbers/ mailboxes on all terminals - the ID on the display tells them which paging terminal to call for their message.

With the release of version 310j0, the paging Notify mode was expanded to provide insurance of overdialed display messages. Now Notify mode can either work as it did previously or the display messages can be insured, similar to Insure mode. This means that a subscriber in the new insured Notify mode will have all overdialed display messages saved in their mailbox.

This feature can be given to all subscribers or just to those subscribers who have Notify and Insure modes. If the feature is given to all subscribers, default values apply to the number of insurance slots and retention time.

The insured Notify feature is set in the options.cus system configuration file. The Notify keyword has some new extensions to control the insurance mode. The general format is as follows:

```
Notify [Old/Or] [IdNone/IdGroup/IdAll] [CheckInsure] [InsureTime hhh InsureSlots nnn]
```

CheckInsure tells the paging terminal to see if a Notify mode subscriber also has an Insurance mode entry. If the subscriber does have Insure mode, then it is used to insure the display message (instead of Notify mode). The Insure mode is hidden from the subscriber's PageSaver access menu so they cannot switch to Insure mode accidentally.

This keyword is used when either:

- all notify subscribers are not getting display messages insured (or)
- some Notify subscribers get more display messages saved than others

InsureTime <hours> sets the maximum length of time that a subscriber can save a display message in their mailbox. InsureSlots <number> sets the maximum number of display messages that a subscriber can save in their mailbox. To assign a default display insurance mode to all Notify subscribers, add these two keywords. These two keywords must be used together and both of their values must be specified.

Note that when a subscriber's display mailbox is full, new display messages will still be saved and the oldest message will be erased. The voice message limit that is set under Notify remains the same. The voice mailbox will not take new messages when it is full.

The three new keywords interact to form four possible modes of operation for Notify display insurance. Table 40 shows each combination and its effects.

*Table 40: Overdialed Display Message Insurance Settings*

| OPTIONS.CUS Notify Setting | Can Switch To Insure Mode? | Overdialed Display Message Results |
|---|---|---|
| none | yes | not insured for any Notify subscribers<br>- old way things worked |
| InsureTime + InsureSlots | yes | insured for Notify + Insure subscribers<br>insured for Notify-only subscribers |
| CheckInsure | no | insured for Notify + Insure subscribers<br>not insured for Notify-only subscribers |
| InsureTime + InsureSlots + CheckInsure | no | insured for Notify + Insure subscribers<br>insured for Notify-only subscribers |

As Table 40 illustrates, there are several different applications of the insured Notify mode. The questions to ask when deciding which Notify settings to use are:

- Which subscribers do you want to have overdialed display messages insured?
  - All subscribers with Notify mode?
  - Just those subscribers with Notify and Insure modes?
  - None of the subscribers?

- Do you want the subscribers to be able to enter switch to Insure mode, even if they have the new insured Notify?

### NumericAllowAlpha

NumericAllowAlpha: If YES, alphanumeric input to a numeric pager will still be sent to the pager. (This usually means the pager will alert but will have garbage on the display). This is how it has worked up until now. If NO, then alphanumeric input from a TAP manual input device will show:

```
Numeric only - page cancelled
```

or a telephone caller will hear reorder instead of 3 beeps at end of call.

### PageNotInPage

The PageNotInPage command affects how Group or Alpha access calls affect individual pagers. If NO (the default), subscribers whose current mode is not P, I, or N cannot be paged. If YES, any subscriber who has a paging mode (as any of their available modes) may be paged from Alpha or Group accesses (or any other non-phone method, except test pages), even if the subscriber's current active mode is not one of the paging modes.

### PageTasks

The PageTasks command should rarely be needed. In the paging terminal software, there are software constructs known as page tasks. They handle part of the call processing. The system determines automatically at boot-up how many to start up. This command allows manual control of this, if needed. Contact Zetron before adjusting this parameter. The MIN value is 1 minimum, the MAX value is 200 maximum.

```
PAGETASKS   MIN 4  MAX 20   ; restrict number of page tasks
```

### PrinterPost

The PrinterPost command is active when the Logging Printer Port option (950-9118) is installed. When enabled, this option causes all entries in the system log files to also be sent to the printer port, for real-time hard copy purposes.

```
PRINTERPOST    ON      ; Send logging information to the printer port
                       ; The keyword YES will also turn the port on.
PRINTERPOST    OFF     ; Don't send logging information to printer port
                       ; The keywords NO and NONE will also disable
                       ; the printer port
PRINTERPOST    2400    ; 2400 baud printer port output
```

ON or YES gives the default baud rate of 4800 baud. You can set the baud rate to 1200, 2400, 4800, or 9600.

**Note** Setting slower than 4800 may degrade system performance.

### PrintOnly / Traffic

The printer posting and the ZlinkW Traffic command both allow the selection of which type of log posting they will display. The traffic command allows this selection by the use of options switches on its command line; however, it also has a default setting for log postings to use. These defaults may be set at system startup by using the PrintOnly, for the printer port, and Traffic, for ZlinkW traffic, options. For either command there should be a parameter, which is of the same form as the ZlinkW traffic commands options. For more information on this subject, see the *ZlinkW "traffic"* on page 342.

```
PRINTONLY   -I!?.   ; printer log just the various failure messages
TRAFFIC     -i.?    ; Traffic defaults to caller and ZBASE problems
```

### QueueLimit / Channel

The QueueLimit and Channel commands are part of the Load Management feature. You can establish a limit for the number of pages stacked up to go out for each station card. Any further calls coming into the system once the station card is at its limit will be rejected. For example, the caller will hear "We are sorry, the system is busy; please call back later". See further discussion in the following pages.

Example:

```
QUEUELIMIT  40
CHANNEL  1 2
QUEUELIMIT  20
CHANNEL 3
```

Values: QueueLimit 1 to 253; OFF, NONE, or NO to disable; or DEFAULT
Channel 1 to 8 - specify one channel or a list

Default if missing or DEFAULT: QueueLimit OFF; no default for Channel #

**Note** The Channel command MUST come AFTER the QueueLimit command.

As of Version 310h0, setting QueueLimit to zero for a channel will disable that channel. Calls to that channel will get the load management prompt. This is useful when servicing transmitter equipment.

### ReminderAge

The ReminderAge command controls the reminder page display message. This message shows both the number of mailbox messages waiting, and the age of the oldest message. Using ReminderAge, you may select if the age is to be displayed in terms of hours or minutes.

```
REMINDERAGE         HOURS     ; oldest message as hours
REMINDERAGE         MINUTES   ; oldest message as minutes
```

The ZlinkW command “note” will display the current reminder settings, as well as any reminder or test pages currently active.

You may disable reminder pages, and thus notify mode, by setting Reminders to zero, or by following either the Reminders or ReminderTime command with the parameter OFF. In a similar fashion, you may set the number of reminders and interval between reminder pages to their defaults by following either command with the ON parameter. When selecting these modes only the Reminders or ReminderTime command should be used, not both commands.

### Reminders

The Reminders command sets the number of notification pages sent for each incoming Notify mode call. The number of reminder notifications may be set from zero, in which case the function is disabled, to a maximum of 255.

```
REMINDERS          3          ;  send 3 reminders per Notify mode page
```

### ReminderTime

The ReminderTime command sets the interval between the sending reminder pages. The range of allowable values is zero to 255 minutes, in 1-minute increments. A value of zero will result in all the reminder pages, as determined by the Reminders command, being sent very quickly.

```
REMINDERTIME       10     ; ten minutes between each reminder page

REMINDERS         OFF     ; disable the sending of Notify reminders
REMINDERS          ON     ; use default values for the generation
                          ; Notify reminders
```

### RetrievalStart

The RetrievalStart command is just like the MailStart command, but applies only to Retrieval records (records with a status of R). The default is NEWEST. This is because callers to status R records have no control over mailbox actions and cannot delete older messages, so we might as well play the newer ones first.

### SilenceDuration / SilenceLevel

The Pause deletion feature is controlled by the SilenceDuration and SilenceLevel commands, if the ADPCM (702-9153) card is installed. The PCM voice controller uses hardware switches to select its options, see *Voice Storage System* on page 197, for more.

The SilenceDuration command needs a single integer value as a parameter. This value is the length of time, in 1/16s of a second, of silence that will trigger pause deletion. Periods of silence less than this time will not be affected. This value should not be set less than 5 (0.32 seconds), as it may cause unpleasant or odd sounding recorded speech. The maximum value is 255, or 16 seconds, which is far too long to be useful. Typically, a value of 5 to 9 works well.

The SilenceLevel command needs a single integer value as a parameter. This value generally should be between 200 and 330, with 300 being near optimal.

If only one of the commands, SilenceLevel, or SilenceDuration, is given and the parameter is OFF, then pause deletion will be inactive. Likewise if one of the two commands is given and the parameter is ON then pause deletion will be active, and will use the standard values of 240 for SilenceLevel and 6 for SilenceDuration. If either command follows any Silence command and has an ON or OFF parameter, it will override the preceding Silence command.

```
SILENCELEVEL       245  ; ADPCM only, set pause deletion threshold level
SILENCEDURATION      7  ; ADPCM only, set pause deletion trigger time
SILENCELEVEL       OFF  ; ADPCM only, disable pause deletion
SILENCEDURATION     ON  ; ADPCM only, enable pause deletion using
                        ; standard values
```

### SpeakTime

The SpeakTime command controls use of the DisplaySaver TimeStamp option, and only applies if your system has that option as part of its PageSaver features. Setting to MANUAL, the default, means people must press the 8 key to hear the time that a message came in. Setting to BEFORE means no user action is required, it will always play the time before playing the mailbox message; AFTER will always play the time after playing the mailbox message. NONE disables the feature (but numeric display insurance still works).

### SysLogs

The SysLogs command is useful on extremely large and busy systems. Normally, there are 20 log files, named LOG00 through LOG19; each is 20K in length. LOG00 is filled up first, then LOG01, etc.; when LOG19 fills, it starts over with LOG00 again, writing over its previous contents. On most systems, these log files give a week or two of history, useful for troubleshooting and analysis. On really busy systems, they might last less than a day. This command allows increasing the number or size of the files in these situations. However, be careful - if you set them too large, you can run out of disk space, messing up paging.

It is recommended that:

SIZE times NUMBER be less than 2 megabytes as a general rule.
SIZE can be 1 to 500,000 (for 300d2 & later it is 1900 to 65,000);
NUMBER can be 2 to 100. Do not set size to greater than 64,000
(due to segment limits).

```
SYSLOGS  SIZE 30000            ; make each log a little bigger
SYSLOGS  NUMBER 30             ; more logs than standard 20
SYSLOGS  SIZE 40000 NUMBER 30  ; bigger logs and more of them
```

### TotalPCM

The TotalPCM command is for systems with all Rev E or newer dual trunks and a lot of trunk routing. It allows a second PCM highway to be used, which increases the system capacity from 24 speech paths to 48 speech paths.

The format of the command is:

```
TOTALPCM  X
```

"X" is 24 or 48. The default is 24; thus, only the form shown here is needed.

```
TOTALPCM 48
```

This command, unlike most other options.cus commands, cannot be changed without a reboot of the system.

### UnusedIsBlocked

The UnusedIsBlocked command affects the way calls to status “U” versus status “I” records are handled. If OFF (the default), calls to status “U” records get the same treatment as calls to status “I” records (it plays the bad number prompt on systems with voice prompts). If ON, status “U” calls get fast busy only, no prompt.

### ValidDestAlways / GroupToValid

ValidDestAlways and GroupToValid are used for VNET systems. They make store and forward easy in the office computer database. If all calls to a store and forward paging terminal are to be forwarded to a main paging terminal, the store-and-forward paging terminal has its options.cus set up with, for example:

```
ValidDestAlways  REMCON
GroupToValid     REMCON
```

and in network.cus there would be a line like:

```
OutBound REMCON  3   99.DENVER.V
```

When set, this overrides the channel/zone settings in the database of the VNET store & forward terminal.

### ZoneDelay

The time interval between pages sent for each of the channel/zone pairs in a subscriber record is controlled by the ZoneDelay value. Values are in terms of 1/100 of a second.

```
ZONEDELAY       0   0   0    ; no delay between sending pages for each
                             ; active channel/zone pair
ZONEDELAY    1000 2000 4000  ; delays between sending pages for each
                             ; active channel/zone pair are active
                             ; delay  10, 20, and 40 seconds respectively
```

The ZoneDelay command is active only when running version 310 ZPAGE with a version 300 database file.

Table 41 provides a summary of the default settings for many of the commands covered up to this point.

All of the options.cus commands have default values that are active until an instance of the command is read in the options.cus file, at which time the default is overridden by the value from the file. If there is more than one occurrence of a given command in a file, the last instance of the command will be the one that takes effect.

## Generic Function Codes

There is a capability we call Generic Function Codes. It is not in the default options.cus file; it can be added if needed. If you need the described features, contact Zetron for assistance in setting it up.

This feature is most useful with Golay (GSC) pagers that have both voice and display capabilities. By using this Generic Function Code capability, callers can select to leave a voice OR a display message with each call. This is particularly useful for emulating this capability of the Motorola Modax paging terminals. It has also been used for HSC pagers.

Subscriber records in ZbaseW need to be set up as follows:

- The pager function code is entered as "C1".
- The display limit is set > 0.
- The voice limit is set > 0.
- Optionally the Security/Function code voice prompt is turned on (good idea, & re-record it to mention choosing voice or display).
- Optionally the Message prompt is turned on.

The caller experiences:

- The caller calls.
- Optionally hears the function code entry voice prompt (best if re-recorded).
- Hears a beep-beep-beep prompt.
- The caller enters 7 for a display page, or defaults to a voice page (or the caller can enter a 1 for a voice page).
- Optionally hears the message prompt, as appropriate for the function code entered, prompting for voice (if 1 or default) or display (if 7).
- Hears a beep-beep-beep prompt if function code 7 - display message.
- Hears a beep if function code 1 / default - voice message.
- Caller enters (speaks or punches in) their message.

*Table 41: Summary of Parameter Defaults*

| Command | Default Value | Notes |
|---|---|---|
| ClientName | ZETRON MODEL 2200 PAGING TERMINAL | — |
| ZoneDelay | 0 0 0 | between each channel/zone pair |
| Installations | 1 | single office site |
| Reminders | 7* | PageSaver only, 2 reminder pages for subscribers in notify mode |
| ReminderTime | 15 | PageSaver only, 15 minutes between Notify mode reminder pages |
| SilenceDuration | 7* | ADPCM only, Pause deletion off |
| SilenceLevel | 240* | ADPCM only, Pause deletion off |
| #Enable | ON | PageSaver only, # key on phone |
| PrinterPost | OFF | only with printer port option |
| ModemInit | AT S0=2 S7=30 S9=06 S10=04 &C1 * | |
| SysLogs | SIZE 20000 NUMBER 40* | |
| PageTasks | MIN 3 MAX 80 | |
| LocalPort | 4800 | |
| PrintOnly | -a | printer log everything |
| Traffic | -i._ | default to pre-310 TRAFFIC |
| TotalPCM | 24 | Only 24 PCM slots to draw on |
| ReminderAge | HOURS | Reminders oldest message as hours terminates owner's call |
| QueueLimit | OFF | no load management active |
| BypassPrio | 4 | priorities 4 & higher bypass priority |
| MaxTalkback | 2 | up to 2 talkback pages in progress/waiting |
| DisplayTime | OFF | do not append time to display messages |
| MailStart | OLDEST | play oldest messages first |
| RetrievalStart | NEWEST | play newest messages first if Retrieval record |
| SpeakTime | MANUAL | user must press 8 for timestamp |
| GroupNote | ON* | group pages to display pagers show pilot # |
| MinimumVoice | 2* | voice messages must be at least 1 second |
| MinimumData | 1* | display messages must be at least 1 character |
| MinimumPrompt | 2* | voice prompts must be at least 2 seconds long |
| UnusedIsBlocked | OFF | status U treated same as status I |
| PageNotInPage | NO | subscribers not in a paging mode cannot be paged |
| MailPurge | 48* | background mailbox cleanup at 2 days |

**Table 38: *Summary of Parameter Defaults (continued)***

| Command | Default Value | Notes |
|---|---|---|
| MaxOwners | 4* | 4 actions can be done in Owners mode |
| MaxRecycle | OFF | call recycling inactive |
| Notify | Old IdNone | act same as older systems |
| FastDTMF | 2000 OneYes | wait 2 seconds after "0", support "1" overdial |
| FaultON | FaultOff | controls activation of Fault Relay |
| FileProbes | CC 20 SDB 20 | over 20 probes reported to log file |
| FollowForward | PHONE | ignore internal fwd on non-phone inputs |
| BlockIfSecurity | PHONE | security code blocks only phone inputs |
| NumericAllowAlpha | YES | alpha sent even to numeric pager |
| ValidDestAlways | (none) | inactive |
| GroupToValid | (none) | inactive |

* These are not the "default if missing" values, but the values we currently use as defaults for new terminals.

The following template can be added to options.cus if this special operation is needed. Usable in ZPAGE 310g8 or later. When inserted in options.cus, this will enable generic function code entry to be used such that a display message OR a voice message can be entered by the caller, and a Motorola Keynote pager will be correctly alerted.

```
;
; OPTIONS.CUS - Generic function code setup for Golay Keynote pagers
;
; Function code table
;
FunctionCode   0 none
FunctionCode   1 voice
FunctionCode   2 none
FunctionCode   3 none
FunctionCode   4 none
FunctionCode   5 none
FunctionCode   6 none
FunctionCode   7 display
FunctionCode   8 none
FunctionCode   9 none
;
;
; Pagercodes table
;                       -- Generic Function Codes --
;          type msgs    0  1  2  3  4  5  6  7  8  9
;
PagerCodes gsc tone     0  0  0  0  0  0  0  0  0  0
PagerCodes gsc voice    0  1  0  0  0  0  0  0  0  0
PagerCodes gsc display  0  0  0  0  0  0  0  7  0  0
PagerCodes gsc both     0  0  0  0  0  0  0  0  0  0
;
; note - all zeros in the above table correspond to impossible-to-reach
;        entries
;
; note: in zlink -
;      the fcode command will display the first table &
;      the pagers command will display the second table
;
;
```

```
; Note, to date, the above mechanism has only been used for HSC and
; Keynote (Golay) pagers. However, it is now available for all formats.
; Where the string "gsc" is in the PagerCodes options.cus lines, the
; following can be used:
;         2tone
;         5tone
;         POCSAG
;         Golay
;         GSC  (gsc & golay are synonyms)
;         HSC
;         D3
;
; Remember - when generic function code processing is enabled via these
; options.cus lines, all caller entered function codes will receive
; generic processing - no matter what format the pager is. Thus this is
; usually only used on a system where function code dependent message
; entry occurs, and no other caller entered function code processing is
; needed. Unless a pager can do voice pages and display pages, the
; mechanism is not needed. Thus, at this point in time, the Shinwa POCSAG
; pagers would appear to be the only other candidate for this handling.
;
;
;          310h1 built-in Golay and POCSAG Voice-or-Display
;          -----------------------------------------------
;
; The above was enhanced in version 310h1.  Default tables for GSC and POCSAG
; are now built in.  The 6f0 or later dual trunk code is needed, and system
; voice prompt 73 is needed.
;
;
; Golay
; -----
; If you program a Golay format pager with a voice limit and a display
; limit, the caller will be prompted for a voice message or a display
; message.  Then whichever type of message is left will be sent to the
; pager.
;
; The function code that will be used for the page is as follows:
;     function code in database:  0  1  2  3  4  5  6  7  8  9
;     function code for voice:    8  3  0  1  6  7  4  5  2  3
;     function code for display:  0  1  2  3  4  5  6  7  8  9
;
; Note that if Send Empty Message is YES, for Golay an empty message is
; always turned into a 1 character display message, so no tone only
; function code is needed.
;
; This mapping can be seen via zlink by running the "pagers" command.
; Just ignore the last column (10) which is seen on this display.
;
; In the M2000, if another mapping is desired, the "PagerCodes gsc voice"
; and "PagerCodes gsc display" lines can be used to set the mapping to
; whatever is desired.  This might be needed if the sysop is doing generic
; function code processing as well as Golay voice or display.
;
;
; POCSAG
; ------
; If you program a POCSAG format pager with a voice limit and a display
; limit, AND a function code other than 4, the caller will be prompted for
; a voice message or a display message.  Then whichever type of message is
; left will be sent to the pager.
;
; If you program with function code 4, the existing voice and display
; message collection and sending will result.
;
; The function code that will be used for the page is as follows:
;     function code in database:  1  2  3  4
;     function code for voice:    4  4  4  4
;     function code for display:  1  2  3  4
;     function code for tone:     1  2  3  4
```

```
;
; This mapping can be seen via zlink by running the "pagers" command.
; However, note that for POCSAG the Zpage function code is 1 less than the
; zbase function code.  Thus if you set a pager up with function code 2 in
; zbase, it will log P1 in the system log.  So the default table as seen
; by the pagers command will be:
;                                 00 01 02 03 04 05 06 07 08 09 10
;                        Voice    03 03 03 03 00 00 00 00 00 00 00
;                      Display    00 01 02 03 00 00 00 00 00 00 00
;                      Display    00 01 02 03 00 00 00 00 00 00 00
;
; In the M2000, if another mapping is desired, the "PagerCodes pocsag
; voice", "PagerCodes pocsag display", and "PagerCodes pocsag tone" (if
; Send Empty Message Yes) lines can be used to set the mapping to whatever
; is desired.
;
; A POCSAG voice or display pager, who is a group member, will use the
; group function code when it is a group member.  If the group is a voice
; and display group, function code 4 had better be used, so that the voice
; and the display message are successfully sent in one page.
```

## Load Management

Load management in 2000 Series paging terminals regulates access to the terminal so that pages accepted from callers are processed within a reasonable length of time.

When the rate at which pages are entered exceeds the rate at which they can be transmitted, the queue of waiting pages grows and the delay before a new page is transmitted increases. The queue also consumes system memory; when memory is exhausted, the processing of pages is delayed without consideration for page priority.

The limit of acceptable delay depends strongly on callers' expectations. If a page is not answered within the expected period, callers will often assume it was lost or missed and enter it again. This produces a positive feedback in the load; once this threshold is crossed, load management becomes necessary.

The need for load management mechanisms indicates that the paging market's demands exceed the terminal's present capacity. This is likely to cause user dissatisfaction and loss of customers. The system operator needs to know when a larger potential market exists so that the system can be expanded accordingly.

The key elements of load management are: restricting entry of pages when system load becomes excessive; monitoring of paging delays and memory usage to detect overload; specifying paging delay and memory usage thresholds which cause load management mechanisms to be invoked; and reporting of overloads to the system operator.

### Load Regulation

All load regulation is achieved by rejecting calls. Call rejection always occurs after the subscriber ID is known. This means that the caller must overdial the ID on an end-to-end line or special DID number. Once the ID is known, load management logic is based on the type and destination of the call and the subscriber's priority.

When a call is rejected, if the system has voice prompts and the "load management" prompt is available, it is played. This prompt should inform callers that their call cannot be

processed and they should try again later. The call is then terminated as appropriate to the line type.

If the call is being rejected because of excessive delays at the transmitter (not because of lack of memory space), PageSaver subscribers may enter owner access mode by overdialing “0” during the load management prompt.

Alpha entry is handled in a similar manner. Alpha entry logon is not restricted by load management. After a pager number is entered, the system load is checked; if the page cannot be accepted, the message “System busy” is displayed on the entry device.

### Performance Monitoring

There are two measures of system performance that must be monitored: memory usage and paging delay time. They differ in that excessive memory usage affects all calls equally (when there is no memory, no calls may be processed), whereas excessive delay may occur on one channel while another may be almost unused.

The system monitors memory that is in use and memory that is available. This information is valuable in making load management decisions.

Paging delay is measured in number of pages queued to a channel. The relationship between the number of pages queued and the average delay will vary from system to system depending on the paging formats in use and must be determined by the system operator.

The destination zone on the channel is not considered in delay calculations. A page on a low-traffic zone only adds to the delay on a busy zone, so it is important to factor in the traffic on the busier zones when deciding whether or not to page.

### Load Management Parameters

The threshold values that activate load management mechanisms are determined by load management parameters. There is thus a close correlation between performance monitoring and the specified parameters. Default values are supplied for parameters not set by the system operator.

The most important consideration in managing memory usage is to ensure that resources are always available for Next Out and Breakthrough pages. A sufficient amount of free memory must be kept in reserve for these high-priority pages. This is specified by an internal software parameter and is not accessible to the system operator. Note that Next Out and Breakthrough priorities must be used very cautiously and sparingly for them to operate correctly.

When a call has been processed to the point where the subscriber has been looked up in the database and the priority is known, if the priority is less than “Next Out” the free memory space is checked. If it is less than the reserved amount, the call is rejected.

PageSaver message retrieval uses a large amount of memory while it is in progress. If a PageSaver subscriber attempts to retrieve messages the free memory is checked again,

with no consideration to priority. If sufficient reserve memory is not available, the call is terminated.

Paging delay parameters are: the queue limit (the maximum allowable number of pages queued to each channel); and the bypass priority (the minimum priority a page must have for it to bypass the paging delay limit and be accepted when the queue exceeds the maximum length at a destination). Each channel has a queue limit and one system-wide bypass priority level.

After the check for free memory space, if the call's priority is below the level that allows it to bypass queue limits, the paging destinations are examined. The queue length at each paging destination is compared to its limit; if the limit is exceeded the call is rejected.

The queue size and bypass priority parameters are programmed in options.cus. The QueueLimit command sets the maximum number of pages that may be queued to any of the channels listed in a subsequent Channel command. Setting it to zero (or OFF, NONE or NO) disables the feature. The Channel command specifies a list of channels to which a previous QueueLimit command is to be applied. The maximum queue limit for all channels is OFF.

The BypassPrio command sets a priority level at which the queue limit is disabled. It accepts arguments in the range 1-4, NEXT (Next Out) or BREAK (Breakthrough). Pages at or above the specified priority bypass the queue length check. The default bypass priority is four.

### Load Management Reporting

All load management actions are reported in the system log file. Rejected calls are logged with a leading character of "-", indicating an error condition requiring the attention of the system operator. The status logged is "no resrc" (no resource) if the memory usage limit was exceeded, or "dest busy" (destination busy) if a channel queue length limit was exceeded. Changes to the values of load management parameters are logged with a leading character of "+", indicating advisory information.

### Critical Load Management

On extremely busy systems, internal load management (not settable by this command) will become active when memory gets very low. Instead of playing a prompt, it will stop scanning the trunk cards, and callers will hear extended ringback, until some pages go out so the system recovers some memory. This applies to trunks, not TNPP. Also, priority B and N pagers bypass this mechanism.

## Commands within TRUNKS.CUS

The trunks.cus configuration file is used for Statistics and special applications. The trunk options are used to set or select various options for trunks. These trunk options are those that concern only Central software, and should not be in oparam.cds, as they do not affect the trunk cards. After each option is set to a value or state, that state remains in effect for all following selected trunks, until it is changed with another command for that option.

### Version 310 Note

The “Security”, “Supergroup”, and “Destinations” commands are new in V310 ZPAGE. The “Priority” command has several new settings, “Break” and “Next”, in order to support the new station code high priority settings. The “Channel” and “Zone” commands are active only when running version 310 ZPAGE with a version 300 database file.

### AllowPrompt

Voice and tone prompts may be disabled and enabled on a trunk by trunk basis with the AllowPrompt command. Normally both prompt types are active, however at times it is useful to disable one or both types. Disabling voice prompts can useful when a line is used by people familiar with the paging terminal, and it is desired to reduce the time from the start of the call until the point paging information is being entered. A local telephone “hot line” is one example where this might be useful. Normally one type of prompt would be left enabled, an exception would be if trunks are connected to the Zetron Model 103, in this case neither voice nor tone prompts are enabled.

```
ALLOWPROMPT    TONE         ; allow tone prompts only (e.g., M103)
ALLOWPROMPT    VOICE        ; allow voice prompts only
ALLOWPROMPT    TONE VOICE   ; allow both tone and voice
ALLOWPROMPT    BOTH         ; allow both tone and voice
ALLOWPROMPT    NONE         ; disable all prompts
ALLOWPROMPT    TONEREC      ; used with VOICE, means to play tone
                            ; prompts instead of voice prompts when
                            ; voice is to be recorded.
```

In version 310j0, two new keywords have been added to the AllowPrompt command in trunks.cus. The first keyword, ETE, enables the end-to-end overdial prompt to play even if voice prompts are disabled. Conversely, the NoETE keyword disables the end-to-end overdial prompt even if the voice prompts are enabled.

The following examples of the new keywords show appropriate format and some possible applications:

```
AllowPrompt   Both   NoETE   ; the end-to-end prompt will not be played
AllowPrompt   Voice  NoETE   ; the end-to-end prompt will not be played
AllowPrompt   Tone   ETE     ; tone-only prompts except for the ETE prompt
```

The end-to-end prompt is normally played for end-to-end lines, DID overdial calls, and call recycled calls. It says, “enter the pager number now”.

The ETE keyword has an alternate use in options.cus. It can call out a file to be used in place of the “sys_end_end” file for the end-to-end prompt. This allows you to play unique end-to-end overdial prompts on different trunks.

The file that is called out in the command line must be located in the voice file system and have a valid name. In addition, a blank space must be inserted between the keyword ETE and the <filename. The examples below illustrate the correct format:

**Example 1**

```
AllowPrompt Both ETE <my_ete
```

**Example 2**

```
AllowPrompt Tone ETE <say_ete
```

Example (1) tells the system to play the voice file "my_ete" as the end-to-end prompt. In Example (2), the system will play tone-only prompts except for the end-to-end prompt which is the voice file "say_ete". Note that even when the ETE keyword is used this way, it continues to function as an enable for the end-to-end prompt in trunks.cus.

You may want to use a general purpose prompt or a subscriber's custom prompt as the end-to-end prompt. In this case, copy the desired voice prompt file to another name using the vget and vput commands.

## AlphaPriority

The priority of a page determines how quickly it advances to the front of the queue to be transmitted. Normally, the priority assigned to a page comes from the priority value set in the subscriber record for the pager being called. The subscriber priority setting can be overridden by a priority assigned to the trunk that the call was received on. The trunk priority is set in the "trunks.cus" file with the Priority command (see *Priority* on page 290 for an explanation of trunk priority settings). In order for a trunk Priority override to take effect on a TAP call the AlphaPriority setting must be changed from the default. AphlaPriority is useful to promote the priority of pages input from high priority sources like a hospital operator or a dispatch center. Alternatively, AlphaPriority may be used to downgrade the priority of pages from a low priority source.

The AlphaPriority command allows the priority of a page to be determined by considering both the page entry method (modem or RS-232 versus DTMF overdial) as well as the trunk on which the page request was received. The paging terminal then assigns a priority to the page based on all of these factors. The ultimate outcome of using the AlphaPriority command is affected by any priority override assigned to the trunk in "trunks.cus".

For the purposes of the AlphaPriority command, the 2000 paging terminal has three sources of page input. They are: DTMF over-dial, POTS phone lines or DID numbers that are configured to return modem tone (for receiving TAP or manual mode pages), and serial lines coming into a port on the multiport card (for receiving TAP or manual mode pages.

The AlphaPriority command has four possible settings. Briefly, their meanings are:

| | |
|---|---|
| User | The page will use the priority assigned in the ZbaseW subscriber record where the “Status” is set to “V”. |
| Access | The page will use the priority assigned in the ZbaseW subscriber record where the “Status” is set to “A”. (Records used to assign modem use to specific telephone numbers for incoming TAP calls). |
| Max | The page will use whichever status has the higher priority setting (the status “V” priority or the status “A” priority). |
| Trunk | The page uses the priority override programmed for the trunk in the “trunks.cus” file. |

Note: Any unique shorter version of the settings may be used, thus U, A, M, and T may be used.

For all of the trunks at default (Priority command in “trunks.cus” has not been used), the effect of the AlphaPriority command for those trunks result in the priorities shown in Table 42.

*Table 42: Results of AlphaPriority when no Trunk Priority is Set*

| AlphaPriority Setting | Pages from DTMF Overdial on Trunk Card | Pages from Modem input on Trunk Card (TAP or manual mode input) | Pages from Multiport Card (via RS-232 or external modem, TAP or manual mode input) |
|---|---|---|---|
| User (or None) | Status **V** priority | Status **V** priority | Status **V** priority |
| Access | Status **V** priority | Status **A** priority | Status **V** priority |
| Max (V > A) | Status **V** priority | Status **V** priority | Status **V** priority |
| Max (A > V) | Status **V** priority | Status **A** priority | Status **V** priority |
| Trunk | Status **V** priority | Status **A** priority | Status **V** priority |

For all of the trunks that have a priority override value set (using the Priority command in “trunks.cus”), the effect of the AlphaPriority command for those trunks result in the priorities shown in Table 43.

*Table 43: Results of AlphaPriority when Trunk Priority is Set*

| AlphaPriority Setting | Pages from DTMF Overdial on Trunk Card | Pages from Modem input on Trunk Card (TAP or manual mode input) | Pages from Multiport Card (via RS-232 or external modem, TAP or manual mode input) |
|---|---|---|---|
| User (or None) | Trunk Priority | Status **V** priority | Status **V** priority |
| Access | Trunk Priority | Status **A** priority | Trunk Priority |
| Max (V > A) | Trunk Priority | Status **V** priority | Trunk Priority |
| Max (A > V) | Trunk Priority | Status **A** priority | Trunk Priority |
| Trunk | Trunk Priority | Trunk Priority | Trunk Priority |

## ANIsend

ANI (automatic number identification) allows the paging terminal to identify the calling party's phone number. The ANIsend command allows the calling party's phone number to be sent to the pager in certain cases. Previously, the pager would be set off with an alert only (if Send Empty Message field was set to "Yes" in ZbaseW).

In Paging and Insured modes the ANI page will only be sent if:

- the trunks.cus file enables ANI sending
- the caller does not key in a message (no characters are received)
- the Send Empty Message field is set to Yes
- the caller stays offhook for the minimum billing time
- the Central Office sent the ANI to the paging terminal

In Insure mode, the ANI will be put into the subscriber's mailbox, just like any other display message.

In Notify mode, it is possible to send a display message just like in Paging and Insure modes. However, it is not possible to have a zero character display message, because then the voice message is chosen. So in Notify mode, the ANI can be postfixed to the PageNote display, but it cannot be sent all alone as the display message. To send the ANI page:

- the trunks.cus file enables ANI sending in Notify mode
- a voice message is left
- the Central Office sent the ANI to the paging terminal

For example, given a call that starts with the following ANI in the log:

```
576-1636  call in prgrs    10:32:41a 2     8AL  ANI=4144571077 00ww
```

A subscriber in Paging or Insured mode would receive the following display page:

4144571077 -or- 414 457-1077 (with autoformatting)

A subscriber in Notify mode would receive the following display page if "Notify IdAll" is enabled:

576-1636 1 000 4144571077

Otherwise, the page would be:

1 000 4144571077

The ANIsend command is set in the trunks.cus file. The format is as follows:

```
ANIsend [LogOn|LogOff] [PIon|PIoff] [NoteOn|NoteOff]
```

The default setting is:

```
ANIsend LogOn PIoff NoteOff
```

LogOn tells the system to write a line to the log when the call starts showing the ANI. (This can only occur if the trunk returns an ANI.)

PIon enables (PIoff disables) sending of the ANI in Paging and Insure modes. (All of the conditions described for this option must be met for this keyword to function.)

NoteOn enables (NoteOff disables) the addition of the ANI to the PageNote in Notify mode.

ANIsend LogOff can be used even if you have not purchased the ANI sending option. It turns off the log entry with the ANI at the beginning of each call.

**Note** The ANIsend Option requires MFR1 (in North America) or MFR2 (outside North America) digit feed to function correctly. Please check with your local phone company before ordering this feature.

### Channel / Zone

Channels and Zones are controlled with the Channel and Zone commands. These commands allow the RF channel and zone values of pages to be selectively overridden on a per-trunk line basis. The commands need at least one channel/zone control value. Each of the channel/zone values corresponds to a channel/zone setting in a ZbaseW record. This override information will be applied in a uniform fashion to Page, Notify, and Insure pages. The allowed values are chosen from the set:

| | |
|---|---|
| 1...4 | RF Channel, for the CHANNEL command |
| 0...15 | RF Zone, for the ZONE command |
| | Override the corresponding position in the subscriber database record. If the subscriber record has a “N” in this position, then it will be inactive. |
| N | Block all pages from this position, regardless of subscriber record value. |
| * | Use whatever value the subscriber record has in this position. If the subscriber record has a “N” in this position, then this position will be inactive. |

For example, the commands:

```
CHANNEL   1  2  *  N
ZONE      5  6  *  8
```

would force a page to appear to have the following values, as it would appear in ZbaseW format:

```
1/5  2/6  C/Z  N/N
```

where C/Z is the Channel/Zone as it appears in the subscriber record of the current call. Note that a “N” in either Channel or Zone of either the subscriber record or the trunk.cus entry will block a page from that position in the Channel/Zone record.

Either the channel or zone information may be over-ridden, without changing the other. For example the following two commands would over-ride the zones for pages on the affected trunks, without changing the channel values from those in the subscriber records.

```
CHANNEL    *  *  *  *   ; do not override subscriber's channel settings
ZONE       4  3  2  1    ; override subscriber zone information
```

### CountPurge

The CountPurge command sets a stale address purge time, to reset the counts on any TNPP source-destination pair that has been inactive for the specified time. As a result, any TNPP addresses that have not been used recently are dropped from the network counts to ensure efficient operation of the paging terminal.

The command line format is as follows:

```
CountPurge  <number>
```

Where the <number> is the number of days that an address must be inactive before the corresponding counts are deleted. The value should be a whole number value between 0 and 36,000 (anything larger would be impractical).

The default setting for this command is 180 days - long enough that it is unlikely to interfere with any use of the network counts file. The CountPurge command can be disabled by using a "0", "Off", or "None" as the <number>.

See *Trunk-based Function Code Override Feature* on page 292 for information on the new FunctionCode setting.

### Group

Trunk Groups are set with the Group command. This sets the trunk group value for all following selected trunks, and will be displayed by the ZlinkW "liu" command.

Trunk groups are needed for Statistics to give good information. The trunk statistics feature collects and displays information on a per trunk group basis.

```
GROUP    group_number        ; value between 1 ... 99, 0 is `ungrouped'
                             ; the keywords `no' or `none' will act
                             ; the same as a zero.
```

### NameConfirm

The NameConfirm setting (new as of 310h1) sets whether a caller using manual TAP input, to input alphanumeric pages, will see the subscriber name echoed to the screen or not. In the past, the default has been YES for Multiport TAP, NO for telephone trunks. This is still the default. Use NO to turn off name echoing to Multiport, or YES to turn it on to dual trunks.

### Priority

The priority of pages may be set on a trunk by trunk basis using the PRIORITY command.

```
PRIORITY        n             ; force page to priority `n', between 0 and 8
PRIORITY        DEFAULT       ; use the priority from subscriber record
PRIORITY        *             ; same as DEFAULT
PRIORITY        BREAK         ; page priority forced to Breakthru priority
PRIORITY        NEXT          ; page priority forced to Nextout priority
PRIORITY        HIGH          ; page priority forced to High priority
PRIORITY        ORDINARY      ; page priority forced to Low priority
PRIORITY        LOW           ; page priority forced to Low priority
PRIORITY        NONE          ; page must age before it gets even Low
                              ; priority.
PRIORITY        n             ; force page to priority 'n', which should
                              ; be between 0 and 8
```

### Security

Checking for Security Code may be disabled or enabled for any trunk with the Security command. When enabled each call will be checked to see if the subscriber has a security code. If they do, then the caller will be asked to enter the code. When disabled for a trunk call, that trunk will never have security code checking performed. The owner's access Personal Passcode and the Prompt Setup number's access code can not be disabled via the trunk Security command, they can be disabled only by removing the access code in the corresponding database records.

```
SECURITY         OFF     ; Security Code will not be checked for.
SECURITY          ON     ; Security Code will be checked for as per
                         ; the called subscriber record.
```

A possible use of the AllowPrompt, Priority, and Security controls might involve a local telephone used for important or emergency paging. As this telephone has restricted access through its physical location and is used only by experienced personal, some shortcuts can be taken. The priority of calls placed using that line could be set to Nextout or Breakthrough. Voice prompts can be eliminated as the users are familiar with the paging system and its tone prompts, thus speeding up message entry. In addition, the security code checking can be eliminated on that line, again speeding up placing of the page.

### Trunk

Trunks to apply the various settings to are selected with the Trunk command. The trunks to apply the settings to may be specified in either of two formats. The first of these is the “V300” format, which is the same as in all versions of ZPAGE prior to the Version 310 release. The format is:

```
TRUNK   card_#|port_#    ( card_#|port_#  card#|port# )
```

The second format uses the card-number unit-letter form of version 310 postings, i.e. “6A” or “10B”. The port letters range from “A” to “H”, only multiport serial cards have ports past “B”. The format is:

```
TRUNK   card_#port_letter    ( card_#port_letter    card_#port_letter )
```

The two formats may be intermixed within a trunks.cus file; there is no need to change from the version 300 format. The values for card_# and port are the same as displayed by

the "liu" ZlinkW command. More than one card - port pair can be selected with a single trunk command, and at least one card - port pair must be specified.

```
TRUNK    7B        ; select card 7 port B
;
; now select both ports A and B on cards 10 through 13
;
TRUNK    10A  10B  11A  11B  12A  12B  13A  13B
```

For each of the value setting commands there is a default value that all trunks will be set to before the trunks.cus file is processed. The default values remain in effect until a selection command is found. Any value not explicitly overridden in the trunks.cus file will be at its default value when a Trunk command is encountered.

*Table 44: Default Settings for TRUNKS.CUS File*

| Command | Default Value | Notes |
|---|---|---|
| Channel | — | use subscriber record's value for channels. |
| Zone | — | use subscriber record's value for zones. |
| Priority | — | use subscriber record's value for page priority. |
| Destinations | — | Use subscriber record's value for page destination. |
| AllowPrompt | Both | allow tone and, if installed, voice prompts. |
| Security | enabled | Enable Security Code checking on trunks. |
| Group | 0 | no trunk groups. |
| Supergroup | — | No Trunk Supergroup settings. |

An example of a trunks.cus file might be:

```
;
;  Trunks.cus for Phast Phreddy's Phrantic Paging
;
    GROUP   1           ; select Trunk Group 1 as current Trunk Group
    TRUNK   7|0         ;    all these trunks
    TRUNK   7|1         ;    are in
    TRUNK   8|0         ;    Trunk Group 1
                        ; and use whatever the subscriber records contain for
                        ; channel and zone information

    GROUP       2       ; now switch to Trunk Group 2

    CHANNEL     1 1 1 1 ; and select RF channel 1 as override channel
    TRUNK   8|1         ;    All these trunks
    TRUNK   9|0         ;    are in
    TRUNK   9|1         ;    Trunk Group 2
    TRUNK  10|0         ;    and have pages forced
    TRUNK  10|1         ;    to have channel set to 1

    CHANNEL     3 3 3 3
    TRUNK  11|0         ; this trunk is in Trunk Group 2 and pages are forced
                        ; to channel 3

    CHANNEL     2 2 2 2
    TRUNK  11|1         ; this trunk is in Trunk Group 2 and pages are forced
                        ; to channel 2

    GROUP      3
    CHANNEL    * * * *
    TRUNK  12A 12B 13A 13B 14A 14B ; these trunks are in trunk group 3
                                   ; and will use channel info from
```

```
                                    ; subscriber database
```

### WinkLimit

The maximum wait time for an outbound trunk can be specified:

```
WinkLimit  <tenths_of_seconds>
```

For instance,

```
WinkLimit 7
```

means wait a maximum of 7/10ths of a second for an outbound trunk to respond.

## Trunk-based Function Code Override Feature

This feature may be used to send a different pager function code for calls placed on a “hot” line. The function code would cause the pager to “beep” differently; signifying that this is a priority page. Such a feature ties right in with the ability to disable voice prompts and security code requests on a per-trunk level.

To make the feature more generally useful the trunk override function code will be treated similar to a generic function code, using the PagerFunction tables to determine the proper pager specific function code to use when sending a page.

The function code override feature is controlled using the FunctionCode keyword in the trunks.cus file. This feature also uses the existing PagerFunction settings in the options.cus file to convert the general function code and message types into the pager specific function code. Please note that none of the keywords are case sensitive, upper and/or lower case letters may be used as desired.

```
FunctionCode    Default         ; old way things worked
FunctionCode    <digit>         ; force function code to <digit>
FunctionCode    <digit>   Caller <option>  Group <option>

    <option> for Caller may be Default, Yes, No
    <option> for Group may be Yes, No
```

When the trunk function code override is disabled the normal subscriber function code setting will be used. This mode is the default mode, and may also be selected by specifying “default” after the “FunctionCode” keyword.

When the feature is enabled, the specified function code digit replaces the normal subscriber function code value. The post-call treatment of the page also changes, treating the trunk override function code as a “generic function code” entry. This causes the look-up and function code conversion using the pager specific tables. Note that only a single digit function code may be specified, the post-call PagerFunction look-up may be used to get the two digit function codes for HSC pagers. The handling of caller entered function and group function codes is controlled by two optional parameters as well as the PagerCode lookup table.

The action taken with caller entered function codes is controlled by the optional “Caller” keyword. Caller entered function codes are specified in ZbaseW by entering “CN” or

"C<digits>" in the function code field. If the "caller" parameter is given it must be followed by one of three keywords that specify the handling of caller enter function codes:

| | |
|---|---|
| NO | Caller entered function codes are ignored, they are overridden by the trunk function code, just as ordinary fixed function codes. The caller will not be prompted for a function code. This is the default if the "caller" keyword was not given. |
| YES | Caller entered function codes defeat the trunk override. Subscribers with caller entered function code set will not be aware of the trunk function code override at all, callers to those subscribers will be prompted for a function code. |
| DEFAULT | The trunk override function code replaces the default function code of the caller entered setting. That is if a subscriber has a function code setting of C2, and the trunk override function code is 3, then the subscriber's function code in effect is C3. Callers will be prompted for a function code, only the default setting will have been changed. |

In the case of group call function codes the optional "Group" keyword will control the action taken. There are only two possible settings for the handling of group call function codes, as the group function code setting does not have the caller entered code choice. One of the two choices must follow the "Group" keyword if it is given:

| | |
|---|---|
| NO | Group function code values are ignored; they are overridden by the trunk function code, just like ordinary function codes. This is the default if the "group" keyword was not given. |
| YES | Group function codes defeat the trunk override. Subscribers within a group will not be aware of the trunk function code override at all, as their normal group function codes will be used. |

### Using the feature

The trunk function code override feature is enabled by placing a FunctionCode line in the trunks.cus file. The options.cus file should have a set of PagerCode entries for all the pagers being used that have function code settings in ZbaseW. There need be no PagerCode setting for combinations that do not exist on the terminal. For example, if there are no voice capable POCSAG pagers than there is no need to have "voice" and "both" settings.

The ZlinkW "liu -o" command was enhanced to display the new feature settings. A new field, titled "Fcode", appears after the "Name" field.

This field consists of three sections. The first section will be a "*" if there is no trunk override function code active, in which case no more information is displayed in the field. If there is an override then the value of the function code digit will be displayed.

Following the function digit will be the values of the “Caller” and “Group” settings. The caller field will be “Y” for “yes”, “N” for “no”, or “D” for the “default” setting. The group setting will be displayed as a “G” if Group is “yes”, or a “-” if Group is “no”.

There are some changes to the log file posting as well. Posting related to a status “G” record, the group master record will have “(group)” in the CAP code field and a lower case “g” in the pager type field. The trunk function code overrides will post as “generic” functions codes, that is “G<digit>”, for the group master and in some error cases. This reflects that the override function code has not been converted to the pager specific function code at that point. Actual pagers should have their function codes posted in the normal fashion.

### Sample TRUNKS.CUS lines

```
FunctionCode 5      Caller default Group yes
Trunk 8a  8B
```

### Sample OPTIONS.CUS lines

```
;
; 'type' is the pager type
;
; 'msgs' is the type of message(s) that a particular page
; has.  For pager types that will ever get voice messages the
; 'voice' and 'both' entries are not needed.
;
; The list 0..9 corresponds to the function code values
; that may have been selected by the trunk overrides.
;
; The list of numbers on each 'PagerCodes' line is the
; set of actual function codes to be used.  You must fill
; in all ten values, even if most of them will never
; be used.
;
;               -- Generic Function Codes -
;          type     msgs     0  1  2  3  4  5  6  7  8  9
;

PagerCodes poc      tone     1  1  1  1  1  1  1  1  1  1
PagerCodes poc      voice    4  4  4  4  4  4  4  4  4  4
PagerCodes poc      display  9  8  7  6  5  4  3  2  1  0
PagerCodes poc      both     4  4  4  4  4  4  4  4  4  4
;
PagerCodes multi    tone     1  1  1  1  1  1  1  1  1  1
PagerCodes multi    voice    4  4  4  4  4  4  4  4  4  4
PagerCodes multi    display  9  8  7  6  5  4  3  2  1  0
PagerCodes multi    both     4  4  4  4  4  4  4  4  4  4 ;
```

## Commands within NETWORK.CUS

The 2000 Series terminal uses the network.cus file to describe its processing of inbound and outbound pages, and the logging of status reports from the network card. There are two main sections to the network.cus file, one for describing the processing of inbound pages, the other one for the processing of outbound pages. These two sections are not physical order dependent sections in the file. Rather they use a key word to tell which section each line refers to. Lines within the network.cus file may be grouped by logical section, such as all inbound control, by node ID, that is, grouping together the outbound, inbound, and logging control for a given secondary node. The lines can even be placed in random order.

## Inbound TNPP Page Mapping

This section addresses the mapping for inbound pages. Both capcode and ID pages are covered. Inbound page handling is described by entries in the INBOUND section of network.cus. These entries have three main parts, the network destination description, the TNPP block type, and the local mapping information. Blanks are used as delimiters between fields within these sections.

A network destination, shown as "net-id" is a set of TNPP node ID values. Each inbound page will have its destination ID checked against the destination node ID values in the inbound section. If the ID is found the page is processed according to the information associated with that ID. If the page's destination ID is not found then the settings of the DEFAULT entry are applied to the page. If there is no explicit DEFAULT entry then the page will be failed, and logged as having an unknown destination.

A network destination is in the form of one of the following formats.

1. A single simple value, such as "0100" or "7".
2. A range of values, specified as value1-value2. Thus "0020-002F" is a range. Blanks are not allowed between the values and the "-".
3. A "wildcard" containing value, using a "?" to indicate a wildcard hexadecimal digit. Thus "0020-002F" could alternatively be specified as "002?". The simple implementation restricts wildcarding to hex format mostly because the code I had on hand uses bit masking to perform the wildcarding. It could be applied to hex or decimal radix with a rewrite to compare decimal addresses as text strings.
4. The key word DEFAULT, implying all destinations not explicitly listed. The DEFAULT entry may appear only once for each class of TNPP block. If not explicitly given the DEFAULT entry will be to FAIL the page as having an unknown destination.

TNPP networking gives each capcode page a total of three fields that affect the page's final destination. The first is the TNPP destination node ID. In the original TNPP specification it was implied that this was the unique ID of a physical TNPP node. Most implementations of TNPP have added the concept of "secondary node IDs", which may be both addresses in addition to a node's primary ID, and addresses that more than one node may recognize as causing local pages. The second and third destination fields are the TNPP RF channel and zone, which are used to determine the local RF channel and zone to use to transmit a received TNPP page on.

Mappings for TNPP capcode pages are flagged by the key word CAP. The basic format of a mapping entry for inbound capcode pages is as follows:

```
INBOUND CAP net-id  original-dest    prior-lo prior-hi local-destination(s)
INBOUND CAP net-id  DEFAULT          prior-lo prior-hi local-destination(s)
INBOUND CAP net-id  DEFAULT          IGNORE
INBOUND CAP net-id  DEFAULT          FAIL
```

The "original-destination" is the TNPP channel and zone values within the capcode page block. Blanks are used as delimiters between fields within a destination, that is original-dest would be typed similar to "23 42". Any one or both of these fields may be in the form of one of the following formats.

- A single simple value, such as “1” or “13”. TNPP channel and zone values range from zero to sixty-three.
- The key word ALL, resulting in the acceptance or matching of any value.
- The key word DEFAULT.

The keyword DEFAULT may be used to replace the original-destination, giving a record used to handle all TNPP channel/zone combinations that are not explicitly defined. Only one CAP DEFAULT line is permitted. The options for the DEFAULT mapping are to apply the priority and destination transform to the CAP page, to IGNORE this page, or to FAIL this page. Pages that are ignored are not logged; pages that are failed will be logged.

The prior-lo and prior-hi values are used to map between TNPP and ZPAGE priorities. They may not be ranges or wild cards. For inbound pages to be locally transmitted the priority-lo value is the value to use for TNPP pages without their priority bit set. The priority-hi value is that to use for TNPP pages with their priority bit set. The priority values match those in ZbaseW and in posting tickets to the log file, thus they are single characters from the set “1234NB”.

The field “local-destination(s)” is one or more destinations to apply to a page that match the net-id and original-destination values. Blanks are used as delimiters between fields within a destination. One or more local destinations may be given for a single net-id CAP original-dest selection. Local RF pages are designated by strings of the form “channel|zones”, similar to the log file format for RF pages. Either one or both of the channel and zone fields may be in the form of one of the following formats.

- A single simple value, such as “10” or “2”. These are Zetron channel and zone values.
- An “pass-through” indicator “*”, resulting in the passing on through of the original values for that field.
- The CHANNEL indicator. This is used to indicate that the TNPP channel value should be used for this field.
- The ZONE indicator. This is used to indicate that the TNPP zone value should be used for this field.

The use of the keywords “Channel” and “Zone” indicates the usage of the channel or zone values from the TNPP page. This is simply a shorthand way to handle those cases where a TNPP Zone value should map to a local RF channel, such as used at Cook's Sacramento site, or similar occasions. It could also be used to remap pages to new TNPP values, however that will not be implemented in this version.

The simplest mapping would be to map a single TNPP node ID, channel, and zone to a single local RF destination. The following entry:

```
“INBOUND CAP DE00  1  1   1 3  2|0S”
```

selects any page with a TNPP node ID of DE00, with a channel value of one and a zone value of one, and maps them to local RF channel two, zone zero. Low priority pages are mapped to a local priority of one, while high priority pages map to a local priority of three.

A slightly more complex case is when a range of selected IDs maps to a single "to" destination. Thus an inbound mapping of:

```
"INBOUND CAP 0100-0105 ALL ALL   1 3    1|1S"
```

selects TNPP node IDs of 100 through 105, with any channel and zone values, and maps them to local RF channel one, zone one. Low priority pages are mapped to a local priority of one, while high priority pages map to a local priority of three.

Another example of many to one mapping might be the collapsing of several TNPP channel values to a single local RF channel. Thus to map channel values of one through twenty five, destination node ID 50, to local RF channel of two:

```
"INBOUND CAP 0050 1-25 ALL    1 3        2|*S"
```

TNPP ID paging does not have the channel and zone settings; these are extracted from the subscriber record in the database. The page priority is obtained in the same fashion. The function code is sent along with the subscriber ID and the message, if any.

The basic formats of mapping entries for inbound ID pages are as follows:

```
INBOUND ID net-id  original-id-range
INBOUND ID net-id  DEFAULT                  PASS
INBOUND ID net-id  DEFAULT                  IGNORE
INBOUND ID net-id  DEFAULT                  FAIL
```

The ID keyword identifies this mapping entry as applying to ID pages. The "original-id-range" is a pair of values bracketing the range of network ID values to respond to. The keyword DEFAULT is for any network ID that does not fall within any specified original id range. Only one DEFAULT line for a given net-id range is permitted. The options for the DEFAULT mapping are to pass the network ID, to IGNORE this page, or to FAIL this page. Pages that are ignored are not logged; pages that are failed will be logged.

### Outbound TNPP Page Mapping

This section addresses the mapping for outbound pages.

The programming of the mapping outbound TNPP pages depends on the version of database that ZPAGE is running on top of. In Version 310, the destination in a subscriber record is an eight-character symbolic destination name. This name is mapped to actual TNPP and local RF paging by the network.cus entries.

One option beyond destination selection that is needed is a way to choose how outbound TNPP pages with voice time are handled. In some cases this is an error, a mistake during ZbaseW entry, and should be logged as such. In other cases it is intended, a subscriber with a non-display pager has been set up in Insure mode and knows to call his mailbox if he does not hear a voice message when he is out of his local coverage area. The following commands are used to select which mode is in effect on the terminal.

```
NETVOICE      ALERT
NETVOICE      FAIL
```

The ALERT option strips any voice message off outbound pages with voice time, turning them into alert only pages or display pages. The voice message information has its

reference count decremented properly. The FAIL setting results in the page failing, being logged as an improper mode. The default setting is to FAIL.

### V310 On A V310 Database

The Network destination in the subscriber record provides a character string that is a symbolic destination. This string will be searched for in a table defined by the OUTBOUND section of network.cus. If the string is not found then the page does not have a known destination, it will be logged as such and fail. This look-up is done before we answer the telephone, and works similar to the valid RF channel check.

The string has a companion list of destinations, which are TNPP node IDs along with the TNPP channel and zone setting to use. For each TNPP destination triplet a network page gets sent to the specified destination. Each TNPP destination is checked against the INBOUND mapping, in order to determine if any local RF pages should be generated. If the node ID is found in the INBOUND table any RF destinations needed are created and added to the ticket.

The format for describing the destinations is:

```
OUTBOUND symbol name  priority  channel|zoneS        (more dest)
OUTBOUND symbol name  priority  node IDN             (more dest)
OUTBOUND symbol name  priority  node ID,TNPP channel,TNPP zoneN (more dest)
OUTBOUND node IDN     priority
OUTBOUND node ID,TNPP channel,TNPP zoneN   priority  (more dest)
OUTBOUND symbol name priority TAP##D channel|zoneS (more dest); TAP outdial
```

The symbol name is a string of normal printable characters, no more than eight characters long. Alternatively the destination may be specified by a TNPP node ID, or a node ID plus TNPP channel and zone values. The format of TNPP node ID, channel, and zone values is described later. The node ID format is less flexible than the symbolic name format. Generally, its use should be restricted to test purposes, or secondary node IDs that functionally are similar to symbolic destinations.

The priority of the outbound TNPP pages is determined by the subscriber's priority. If the subscriber's priority is greater than or equal to "4" then the TNPP page will be sent with its high priority flag set, otherwise it will be a low (or ordinary) priority page.

Valid values are "4" and *:

4 - Normal TNPP subscriber priorities 1, 2, and 3 are sent with TNPP low priority. Subscriber priorities 4, N, and B are sent with TNPP high priority.

* - Subscriber priority affects node ID. The subscriber's priority is added to the node ID to cause the page to be sent to different nodes based on priority. For priority 1, the node ID is used. For priority 2, the node ID + 1 is used. For priority 3, the node ID + 2 is used, and for priority 4 node ID + 3 is used. For a priority of N or B the value node ID + 4 is used.

The actual destinations for the page follow the priority field. Both TNPP destinations and local RF destinations may be specified. In general when the parameter following the

OUTBOUND keyword is a symbol name or a secondary node ID, no local destinations should be specified here. Local paging should be set once with the matching INBOUND destination entries. This assures that a change to local paging parameters affects both locally originated and incoming network pages.

Node ID is a hexadecimal number, limited to the range of 0001 to FFFF. The TNPP channel and TNPP zone values are decimal integers in the range of zero through sixty-three. Note that the three values are delimited by ",". More than a single destination may be specified; each destination triplet is separated from the previous destination by white space.

Local (RF) destinations are specified by channel and zone number. The zone value follows the channel, and is separated from it by a vertical bar "|". The zone value is followed by a "S", and no spaces are allowed between any parts of a RF description.

### Sample TNPP NETWORK.CUS Set-ups

The following is an example of the simplest mappings, single node IDs with no secondary addresses or symbolic names.

| | | |
|---|---|---|
| OUTBOUND | 0110,1,0N 1\|5S | We send to node 110, using TNPP settings of channel 1 and zone 0. Pages of priority 3 and above go out as high priority pages. Locally we will transmit the page on channel one, zone five. |
| INBOUND | CAP 112 1 0 1 3 1\|5S | We accept capcode pages sent to node 112, which is the "us" address, with TNPP channel and zone values of 1,0. If the page is low priority use a local priority of 1, if high use a local priority of 3. Send these pages to channel 1, zone 5. |

In this next example, the network has several terminals that share a secondary TNPP node ID for regional pages. This node is based on the area code, "509", and is entered as "5090". Note that while this is a hexadecimal value in the logs it gives "5090" to match the decimal value of the area code. The outbound section does not contain any RF information, as that is derived from the inbound mapping for the node ID. This insures that incoming pages and outgoing pages for network address 5090 will both be paged the same locally.

| | | |
|---|---|---|
| OUTBOUND | 5090 2 | Pages of priority 2 and above are treated as network high priority. |
| INBOUND | CAP 5090 Default 1 2 1\|0S | Incoming capcode pages to ID 5090, any TNPP channel and zone, are sent to local RF channel 1, zone 0. If the network page has its high priority bit set the page gets a local priority of 2; otherwise it is priority one. |

The next example uses a symbolic destination ID. Symbolic IDs are useful in several ways. One is that the actual destination IDs are hidden from the database entry, meaning that if the network or RF information changes the database entries need not be changed,

but only a few lines in network.cus and oparam.cds. A second advantage of symbolic IDs is that it can be easier to assign meaning to the destinations. As an example, a system operator might have symbolic destinations of LOCAL_P5, LOCAL_P6, WIDE_P5, and WIDE_P6, for local and wide area paging for P5 and P6 pagers. One of those four destinations would be entered in a subscriber record for the Network destination.

| | | |
|---|---|---|
| OUTBOUND | WIDE_P5 2 5090N | Pages of priority 2 and above are treated as network high priority. The destination node ID used is “5090”. |
| OUTBOUND | M600 * B000N | Pages are sent to different TNPP destinations depending on their priority. The main use for this feature is to allow a Model 600 to prioritize incoming TNPP pages based on the originating subscriber's priority setting or by 2000 Series priority overrides. (This feature was created for use with the Model 600.) |
| INBOUND | CAP 5090 Default 1 2 1\|8S | Incoming capcode pages to ID 5090, any TNPP channel and zone, are sent to local RF channel 1, zone 8. |
| OUTBOUND | LOCAL_P5 2 1\|8S | Local P5 pages are on channel 1, zone 8. |

Again the outbound section does not contain any RF information, as that is derived from the inbound mapping for the node ID. If at some time in the future the single channel gets too busy and the P5 frequency is split off to a second channel only the INBOUND and OUTBOUND LOCAL_P5 specifications will need to be changed. All subscribers with LOCAL_P5 or WIDE_P5 need not be changed.

# TNPP and System Startup Events Reporting

A new feature has been added to ZPAGE to report TNPP link status and all system startups. The events subsystem reports various unexpected and atypical incidents, such as a TNPP link going down. Generally, events are defined as unwelcome occurrences that cannot be tested for at will. For instance, a subscriber programming error does not qualify as an event, but an unknown node destination error does. For a list of all the possible TNPP events see Table 46.

## Types of Events

There are two sets of event types that can be reported:

- TNPP events - report problems within the TNPP subsystem
- System startups - report any terminal reboot
    - shows the time that paging operations return to active

## Actions Taken

The paging terminal can react to an event occurrence with one or both of the following:

- The FaultRelay action turns on the fault relay for two to three seconds.
- The Page action sends an alphanumeric display page to the specified pager ID (usually the system operator). The page is sent at the priority level of the subscriber record.

## System Configuration Files

Two different system configuration files control events reporting:

- The events.cus file controls which events (TNPP and/or system startups) are monitored and what actions are taken when an event occurs (Page and/or FaultRelay).
- The network.cus file controls the reporting of each event occurrence. Moreover, this file determines which ports are supervised and which subtypes of events trigger a message.

Each file must be set separately, however they must work together to create the desired results. For example, if the events.cus file specifies pages upon TNPP events, then the network.cus file must indicate the types of TNPP events, and on which ports, that should trigger those pages.

## EVENTS.CUS

The events.cus file has two possible command lines for controlling the events reporting. Their basic formats are as follows:

```
StartUp    Page<subscriber-id> "<msg>" FaultRelay
TNPP       Page<subscriber-id> "<msg>" FaultRelay
```

StartUp and TNPP refer to the type of event on which to act. Page and FaultRelay refer to the action(s) to take.

- both keywords are optional
- the order of these two keywords does not matter
  - however, the Page action is always performed first
- FaultRelay requires no parameters
  - if the keyword is used, the fault relay is turned on

The field <subscriber-id> refers to whom should receive the event page.

- must be an existing subscriber record with status V (valid) or G (group call)
- must have an alphanumeric display pager

The field <msg> refers to any custom display message.

- this field is optional - default values are often sufficient

- any text string that does not have quotes (“ “) within it is valid

### Custom Messages

The alphanumeric messages sent to alert the system operator of an event can be customized, as shown in the format above. The custom display message consists of two parts. The custom portion of the display page is set in the events.cus file. It consists of a text string within quotes (“<msg>” field), immediately following the <subscriber-id> field. The second part of the message is predefined by Zetron, and it describes the details of the source event.

For example, if the “<msg>” field were set to “***TNPP problem***” in events.cus, the following display message would be sent on failure of Port 7:

```
***TNPP problem*** Port 7 Down
```

### Default Messages

When the default values are used, the alphanumeric message consists of three parts. The first part is the identification of the subsystem that generated the message (TNPP or Startup). The second section of the message is a description of the source event. The last part of the display message is the site identification string (set in options.cus with the ClientName command).

Using the same event as in the last example and a ClientName of “Z99999 My Paging Terminal”, the events page would be:

```
TNPP Port 7 Down Z99999 My Paging Terminal
```

Notice that the default message is fairly descriptive and in most cases will not require customization. In this example, the default page is actually more complete than the custom one above.

## Events Table

The events.cus command lines describe a 2x2 table that can be displayed using the ZlinkW events command. The events table shows the last occurrence (since the last reboot) and the message sent for each type of event (TNPP or StartUp). The command format is as follows:

```
+ events
```

There are three switches available for the events command. They are -d to display events history, -p for events programming, and -z to zero-out events history.

For example, the following events.cus file:

```
StartUp    Page    123-4567 "System Startup"
TNPP       Page    123-4567 "**TNPP problem**"    FaultRelay
```

Would correspond to the following events table:

| Action Event Type | Page | FaultRelay |
|---|---|---|
| StartUp | 123-4567 “System Startup” | |
| TNPP | 123-4567 “**TNPP problem**” | ON |

In addition to the above entries, the time of the last occurrence is kept in the event table. The last occurrence information will be displayed if the event happened since the last reboot or if the -d switch is used.

## NETWORK.CUS

The network.cus command line that controls events reporting is formatted as follows:

```
PORTS <port-selection> REPORT <events-selection>
```

PORTS is the command keyword that tells the system to report events on the specified port(s).

The field <port-selection> identifies which port(s) should report the specified events. Table 50 shows what types of entries are valid.

REPORT is a command keyword that tells the system to report upon the specified event(s).

*Table 45: Valid Entries for the <port selection> Field*

| <port selection> Text | Ports to Monitor (1 through 8) |
|---|---|
| * | all TNPP serial ports |
| ALL | all TNPP serial ports |
| 1 | a specific port number (port 1 in this case) |
| 245 | all ports listed (ports 2, 4, and 5 in this case) |

The field <events-selection> identifies which TNPP events to report. Table 46 shows the currently supported events and the command line keywords to identify them.

*Table 46: Reported TNPP Events*

| Event Keyword | Description of TNPP Event |
|---|---|
| LinkDown | link to other node has gone down<br>(or) powerup (immediately followed by LinkUp report) |
| LinkUp | link to other node has been established |
| DestDown | destination port is down; usually ReSend tries counted out |
| NAKexpired | transmitted packet got too many NAKs |
| RSexpired | ReSend count expired; usually link is too busy |
| BadCRC | received packet with CRC error; usually link interference |
| CANreply | other node did not like packet; usually unknown destination node ID |
| UnknownDst | unknown node ID, got packet & could not route it |
| ZeroInertia | got packet to route with inertia = 1 |
| ResetIn | other node sent RESET packet |
| ResetOut | RESET packet sent to other node |
| NONE | turn off all events reporting for specified ports |
| NO | turn off all events reporting for specified ports |
| OFF | turn off all events reporting for specified ports |

The network.cus file can have more than one ports... report command line, however if the lines are contradictory, the last command line is always implemented. TNPP events reporting can be customized by using several network.cus command lines to configure each port individually.

The following lines are some examples of valid network.cus entries. Several of these lines could be combined in one network.cus file.

```
ports 1  report LinkDown ResetIn LinkUp
ports 2 5 7 8  report ResetIn linkup
PORTS 3  report None
Ports 4  report UnknownDst NAKexpired DestDown
Ports ALL  report None             ; turns off all TNPP reporting
```

## Log Posting

When an event is reported, it gets noted in the current log file. The general form is as follows:

```
@ <timestamp> <event-type> <event-message> <actions-to-take>
```

When a customized message string (“<msg>” field) is specified, it appears in the log file right after the <event-message> entry.

All events pages are sent at the priority of the subscriber record. They are logged much like normal pages, except their source field is Event! rather than a trunk, and their subscriber status field is `evnt pg`.

Here is an example system log file fragment:

```
- NET88DB port Link Down  10:53:34a * 1,5555N
@ 11nov94 10:53:30a TNPP 'Port 1 Down'Does: FaultRelay, Page,
@ 11nov94 10:53:30a TNPP Action: FaultRelay = ', Port 1 Down' succeeded.
@ 11nov94 10:53:33a TNPP Action: Page 30 = ', Port 1 Down' succeeded.
0030 evnt pg sent 10:53:38a B Event! 1|00S p1 01234567 D 16 TNPP Port 1 Do
```

# Remote Maintenance

This chapter describes the operation of ZlinkW; the full-duplex Zetron communications program provided to remotely control your paging terminal.

## Overview of Communication with Paging Terminal

The ZlinkW communications program is a full duplex, error correcting, multi-channel, Zetron proprietary, communications package. It links your office computer to the 2000 Series Paging Terminal. The exclusive nature of the communications protocol used insures that “computer hackers” cannot “break into” your paging terminal. Further, there is a password to protect you, in the unlikely event that someone who has a copy of the ZlinkW software, and knowledge of the maintenance port phone number for your paging terminal, were to attempt to access your paging terminal, without your permission.

This section provides an overview of all the commands available in your paging terminal via ZlinkW. The office computer software system, ZbaseW, utilizes ZlinkW to update the subscriber, group, and message databases in the paging terminal and it also uses ZlinkW to return call counts. All the commonly used ZlinkW commands are run automatically by ZbaseW. However there are a few commands, such as setting the clock forward and backward, which require ZlinkW to be run directly. From the Communications menu in ZbaseW, selecting the ZlinkW option will run ZlinkW directly for you.

Once you are successfully connected to the 2000 Series Paging Terminal, ZlinkW will display the “+” prompt. Then you can type in any of the ZlinkW commands described in this chapter.

# Installing ZlinkW

♦ ¨ **Installing ZlinkW under Windows XP:**

1. Place the software distribution CD-ROM disk in the computer CD-ROM drive.
2. If the CD_ROM does not start automatically, click the **Start** button and select **Run**.
3. In the file navigation window that opens, click on the **Browse** button, find the CD-ROM drive containing the disk and click on it.
4. On the CD-ROM, find and select the file `setup.exe` and then click the **Open** button. Verify that the filename appears in the dialog box and click the **OK** button.
5. In the window that opens, select the **ZlinkW** installation from the options offered.
6. Follow the instructions of the ZlinkW installer. When its has finished the installation, remove the disk from the computer.
7. Open the Start menu and locate the icon for the ZlinkW program. Click on the icon and ZlinkW should load and run correctly.

# Starting and Exiting ZlinkW

ZlinkW can be started from within the ZbaseW program or manually from the Windows® Start menu. When you exit ZlinkW, you automatically return to either ZbaseW or to Windows, whichever one you originally started from.

♦ **Starting ZlinkW from Windows®:**

1. Open the **Start** menu and position the cursor over the All Programs icon.
2. When the expanded list of programs opens, position the cursor over the **ZlinkW** icon and click on it.
3. When the ZlinkW window opens, position and size the window to suit your s needs.

♦ **Starting ZlinkW from within ZbaseW:**

1. With ZbaseW running, select the **Comm** tab in the main window.
2. From the Comm tab, select the **ZlinkW** button.
3. The ZlinkW window opens and ZlinkW automatically attempts to establish communications with the paging terminal; based on the last settings entered in its Properties dialog.

♦ **Exiting ZlinkW:**

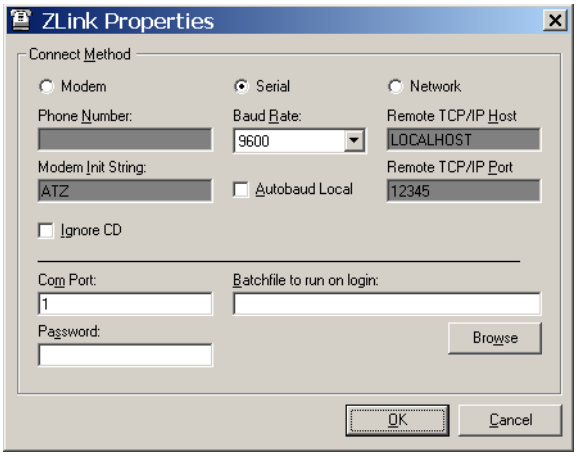
1. You can exit the ZlinkW program by either opening the File menu and selecting the **Exit** option or by clicking on the window **Close** button in the upper right corner of the window.
2. When ZlinkW closes, you are returned either to the ZbaseW Comm tab in the main window or to the desktop, depending on where you started out from.

# Configuring Communications from within ZlinkW

The procedure described here assumes that for some reason you have started ZlinkW independently of the ZbaseW program. Normally, it is expected that you will be running the ZbaseW program and that you will specify the paging terminal to communicate with from within either of those programs.

♦ ¨ **Setting ZLINK Communication Properties**

1. From the ZlinkW menu bar, select the **Communications** menu.
2. From the Communications menu, select the **Properties** option. The ZlinkW Properties dialog will open.
3. In the ZlinkW Properties dialog, select one of the three option buttons across the top to specify the mode of communications being used: **Modem**, **Serial**, or **Network**. The dialog will disable some of the fields in the window based on the mode of communication you select.




4. Fill out the remaining fields to support the communications mode selected in the preceding step.
5. Click on the **OK** button to save the settings exit this dialog.

## ZlinkW Properties Fields

What follows is a brief description of the fields in the ZlinkW Properties dialog box.

### Modem

This mode of operation assumes that both the PC running ZlinkW and the paging terminal have modems attached to them. You will need to supply the phone number of the modem attached to the paging terminal and any necessary initialization string for the modem attached to the PC.

### Serial

This mode of operation assumes a straight serial connection between the PC and the paging terminal. You will need to specify the baud rate for the connection and the COM port being used.

### Network

This mode of operation assumes that there is a IP-Network-to-Serial Port adapter attached to the serial port of the paging terminal. You will have to supply the IP address of the adapter attached to the serial port on the paging terminal and the port number being used by that adapter for raw TCP data.

### Phone Number

This field is for the phone number that the modem attached to the computer must dial in order to reach the modem attached to the paging terminal. The phone number can be prefixed with a “Bxxxx” to set the baud rate the modem is set to prior to the CONNECT string occurring. (See *Local Connections* on page 313 for a list of the 4-digit baud rate settings.) Alternatively, the phone number can be prefixed with “Dxxxx” to set the baud rate the modem is set to for the entire session.

If ZlinkW has been invoked from within ZbaseW for network-based communications, you will see a string with the format Nxxx.xxx.xxx.xxx:ppppp displayed in the Phone Number field. See *IP Network Connections* on page 314 for more information on what this means.

### Baud Rate

This field sets the baud rate used for the serial port in the Serial mode. Use the arrow on the right to open the drop-down list and select the desired baud rate.

### Remote TCP/IP Host

This field is used for the Network mode of communication. Enter the IP address for the network-to-serial converter attached to the paging terminal. For example:  169.254.4.229

### Modem Init String

This field is used to enter a modem initialization string if it is necessary to configure the modem to something other than its default settings.

### Autobaud Local

This check box modifies the behavior of a local serial connection. It has no effect on a modem connection. Checking this box allows the computer to try other baud rates if it does not establish a connection using the baud rate selected in the baud rate field. It will try all of the available baud rates until it makes a connection with the paging terminal. If the baud rate originally specified was correct, then checking this box will have no affect on operation.

### Remote TCP/IP Port

This field is for specifying the IP port number to be used at the network-to-serial adapter attached to the paging terminal. The port number will be supplied by the software configuration tool that came with the adapter when you set the IP address.

### Ignore CD

This item works with the **Modem** mode. If this box is checked, the modem will not disconnect automatically on loss of carrier.

### Com Port

This field is used with both the **Modem** and the **Serial** modes of operation to specify the PC serial port used for the communications link.

### Batch file to run on login

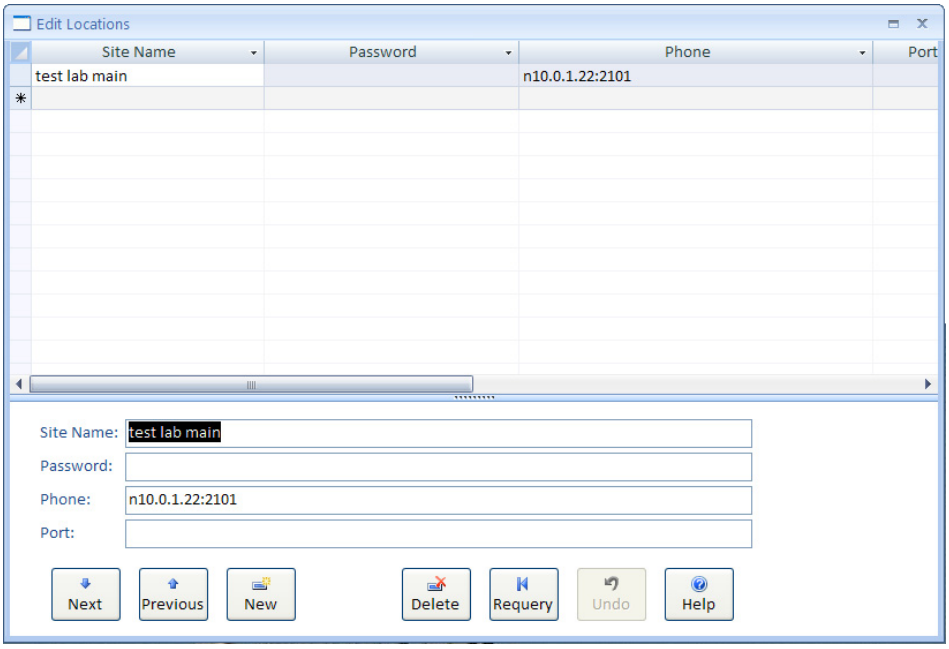
This field specifies a batch file for the PC to execute after it logs on to the paging terminal. It is best that you do not attempt to enter anything here from ZlinkW. If you last ran ZlinkW as part of a ZbaseW command, you will find a batch file listed here.

### Password

This field holds a password to be used by the PC to log on to the paging terminal. If you know the correct password, you can enter it in this field. If you have made a connection from within ZbaseW, then this field will already hold whatever password you used last.

# Making a Connection from ZbaseW

Making a connection with ZlinkW will most often be carried out by opening the Communications window in ZbaseW. This section covers some of the minor differences between doing this with previous versions of ZlinkW and this one.




### ♦ ¨ Setting up a Location for a Communications Link

1. Open the Edit menu in ZbaseW and select the Location option.
2. Click the **New** button to set up a new site.
3. Fill in the blanks in the lower left of the window by typing. Press **ENTER** when the entry is done and the cursor will move to the next field automatically. You can also use the arrow keys to move between fields.
4. When you are finished entering settings for this location, click the **Close** button to return to the Main Menu window.

The Table 47 provides a brief description of the fields in this window.

*Table 47: COMM Parameters for ZBASE*

| Parameter | Description |
|---|---|
| Site Name | The Paging Terminal Site is just a reminder name. The name will be shown each time you link up to the paging terminal. If you do not have multiple sites, you may just leave it blank. |
| Password | The Password allows for maximum security of your paging terminal data. A person intent on gaining unauthorized access to your paging terminal would need to know your paging terminal's phone number & password, plus have a copy of ZlinkW. The password is entered here and automatically used by ZbaseW when it transfers data to and from the paging terminal. This means you do not need to memorize it. |
| Phone | The Phone Number field is used to input the phone number (complete dialing string actually) for modem connections, specify baud rate for local connections, and to supply the IP address and port number for network connections. More details on all of these follow this table. |
| Port | The Port field is used to identify which COM port on the PC is being used for the local serial or modem connection. This will most often be set either “1” or “2”. |

## Modem Connections

If a modem is being used (internal or external connected to a serial port on the PC), you simply type the telephone number to be dialed into the Phone Number field. You do not have to hyphenate the number; however, you may do so to make it more readable if you prefer. The ZlinkW will ignore the hyphens.

If you require any special dialing features in order to place an outside call through your office telephone system, consult the documentation for your modem and add the necessary characters to the dialing string.

If no prefix is added, ZbaseW defaults to behavior consistent with a prefix of “B3840” (connect at 38,400 baud and then shift baud rate after connection if necessary). If other behavior is required, a different prefix should be added.

## Local Connections

The letter “L” is used to indicate that a direct local connection is being used; from the serial port on the PC to the serial port on the paging terminal. If no additional information is provided in the dialing string, the default baud rate of 4800 will be used. An entry in the format of “Bxxxx” is used to set the baud rate used for the connection. The string “xxxx” is a 4-digit number for the baud rate.

| | |
|---|---|
| B0300 = 300 baud | B1440 = 14,400 baud |
| B1200 = 1200 baud | B1920 = 19,200 baud |
| B2400 = 2400 baud | B2880 = 28,800 baud |
| B4800 = 4800 baud | B3840 = 38,400 baud |
| B9600 = 9600 baud | |

The string for specifying the baud rate and indicating that a local serial connection is in use can be entered in two ways. You could type “B3840L” or you can type “L3840”. Both strings are interpreted the same way by ZlinkW.

### IP Network Connections

The letter "N" is used in the Phone Number field to indicate that a network connection is being used. The "N" is followed by the IP address of the paging terminal and the port number being used on the network-to-serial port adapter attached to it. The address and port number are separated by a colon. For example, the following string indicates the connection is a network connection to IP address 169.254.4.229 through port 2101.

N169.254.4.229:2101

## ZlinkW Command Reference

The ZlinkW commands are listed briefly in Table 48. If any options or parameters are available for a command, you would enter those options on the same line as the command. Following the table are more detailed descriptions for some of the more important commands.

If a paging terminal or office computer is running earlier versions of software, some commands will not work, or will work a bit differently. (ZlinkW version 5.32, ZPAGE version 310h1)

*Table 48: ZlinkW Commands*

| Command | Options/ Parameters | Action |
|---|---|---|
| ? | | Gives a “quick help” summary list of the commands in this table. |
| alarms | | Put alarm data files MESSAGES.BIN and MESSAGES.TXT from office computer to paging terminal (only applies if you have the Alarm Monitoring option). The ZbaseW Comm Update menu item does this command for you. |
| batchrun | filename | Executes a file of ZlinkW commands. Usually used by Zetron for service support services. Batch files can be nested. |
| cards | | Display card configuration information |
| cd | | The cd command will display the current directory, which is the working directory for ZPAGE. |
| cls, clreos, cr | | Clear Screen, Clear to End Of Screen, Carriage Return - these commands are useful mostly with the Repeat command to improve display readability. |
| chsdb | filename | Change to a new subscriber data file named filename. See the newsdb command for the modern way to do it. |
| copy<br>(or cp) | source_spec<br>[destination_spec] | The copy command lists the file size, in bytes, and then the file name. It then attempts to copy the file, and prints the results along the right hand side of the line. If the copy succeeds, this will just be the path and file name copied to, otherwise an error message will be displayed.<br>The source spec may include a path, and the filename may include wildcards. The destination spec is optional, if omitted the files will be copied to the current directory (C:\ZDIR). If given it may include a path and wildcards in the filename. If the source and destination paths and names do not differ then an error message will be displayed and no files will be affected.<br>file size source path and name<br>1240 C:\0TEMP\0000<br>destination path and name<br>C:\TNPP\0000.<br>After all files are processed, the total number of files and total bytes copied will be displayed. |
| cpa | <br>current<br>delete<br>old<br>rollover<br>see nnnnnnn<br>time | Get call accounting information from paging terminal.<br>gets copy of all current accumulating counts<br>get individual subscriber(s) counts and zero out totals<br>gets copy of old previous period’s counts<br>gets copy of all current counts & clears totals to 0<br>get individual subscriber(s) counts<br>display time when last rollover done<br>There are ZbaseW menu items that correspond to all of the above options.<br>This function may be disabled by opening the OPTIONS.CUS file and setting “FileProbes CC 0” |

*Table 48: ZlinkW Commands (continued)*

| Command | Options/ Parameters | Action |
|---|---|---|
| date | <br><br>mm-dd-yy<br>ddmmmyy | See and/or set the date in the paging terminal. Type with no options to see the date and not change it.<br>month-day-year, all in 2 digit form<br>day, followed by month (3 letters), followed by year |
| del (or rm) | filename<br>\direc\file | Delete specified file.<br>specified file in specified subdirectory |
| df | x | Disk free space on drive x. Defaults to main drive. In version 310J0 and later, this command reports disk free, disk used, total bytes, and cluster size. |
| dir | | Display the paging terminal non-voice files, see ls for details. |
| diskio | | Diagnostic to check disk read/write errors. |
| dos | dos-command | Will cause the DOS command “dos-command” to be executed on the office computer. |
| echo | string | Batch file command (ZlinkW local command). |
| erase | | Same as “del”. |
| fcode | | Shows the FunctionCode table (Generic Function Code feature). |
| files | | Diagnostic that shows information on open files. |
| get | filename<br><br><br>file1 file2 | Get a copy of filename from paging terminal. If you just specify filename it will arrive as filename.<br><br>To get file1 from paging terminal and name it file2 on the office computer. Full file path names can be used. |
| getsub<br>(or getsubs) | nnnnnnn | Get current subs2000.bin record for subscriber nnnnnnn and put it on office computer in the file subs2000.ret. Multiple Ids (nnnnnnn), separated by spaces, may be specified. The ZbaseW Comm Subscribers menu item uses this command. |
| group | | Put group data file GROUP.BIN from office computer to paging terminal. The ZBASE Comm Update menu item does this command for you. |
| handles | | Diagnostic that shows information on open files. |
| head | filename n<br><br>-a<br>filename n x | Show first part of file on screen, n lines (default = 20)<br><br>Show the whole file. Creates file named filetail on the PC. “x” is anything. |
| heap | -v | Diagnostic showing a software statistic. -v gives additional diagnostics. |
| help | | Does same as “?”. |
| lastboot | | Shows when system last rebooted and why. |

*Table 48: ZlinkW Commands (continued)*

| Command | Options/ Parameters | Action |
|---|---|---|
| liu | <br>-a<br>-g<br>-i<br>-o<br>-s | Display trunk card activity<br>Active trunks only<br>display Group trunk information<br>Inactive trunks only<br>show Override information<br>show State information (Default) |
| loadcard card# | [image_file_name] | Reload a card with software. Currently cannot be used on Station card. The card number is in decimal. |
| log | | Prints the name, size, and time stamp of the current log file. |
| logappend | filename | Lets you keep a log of a ZlinkW session, usually for diagnostic purposes (adds to an existing file). |
| logopen | filename | Logopen starts a new file while logappend adds to an existing file. |
| logclose | filename | Closes (stops logging to) the file of logopen or logappend. |
| ls | <br>/a<br>/d<br>/h<br>/l<br>\directory<br>/r<br>/t<br>/u<br>/v<br>/c | Display the paging terminal non-voice files.<br>all files, including hidden ones<br>subdirectory no detail<br>help information<br>long form directory display<br>select particular directory<br>show in reverse name or time order<br>show in date and time order<br>unalphabetized, first file (DOS) first<br>verbose<br>of displayed files - total number & total size |
| mailbox | | View contents of owner files. Diagnostic command. |
| messages | | Put canned alpha messages file from office computer to paging terminal. The ZbaseW Comm Update menu item does this command for you. |
| mkdir | directory | Make a new subdirectory “directory” on the paging (or md) terminal. |
| move (or mv) | old_spec new_spec | The move command will change the directory a file or files is in. The original directory and the name or names of the files to move is given by old_spec, which may include a path and may have wildcards in the filename in order to specify more than one file. The new directory is given by new_spec, as any filename is ignored just the new directory name need be given.<br>If either specification does not include an explicit path the current directory (C:\ZDIR) will be assumed. If the source and destination paths do not differ then an error message will be displayed and no files will be affected.<br>After all files are processed the total number of files affect will be displayed. |

*Table 48: ZlinkW Commands (continued)*

| Command | Options/ Parameters | Action |
|---|---|---|
| mstatus | | Show status of mirrored voice system, if active. |
| newsdb | | Command for safely transferring a new subs2000.bin subscriber database file from the office computer to the paging terminal, and then making it the current subscriber file. |
| niu | <br>-i<br>-l<br>-o<br>-s<br>-d<br>-c<br>-r | Shows status of Network Interface Units, similar to LIU command.<br>Inbound mapping<br>Link states<br>Outbound mapping<br>Status<br>Call counts display<br>Retrieve counts to network.ret ASCII file<br>Rollover counts |
| note | | Display any active Notify-Reminder and Test pages. |
| page | sub_ID (option switches)<br><br>-k<br>-a<br>-c<br>-d<br>-v<br>-t<br>-r<br>-i<br>-p<br>-f | Start a test page using subscriber ID "sub_ID". The subscriber must be in the database and must have at least one of the "paging" mode Paging, Insure, or Notify.<br>Kill test page<br>Align page times<br>append Counter to msg<br>set Display message<br>select Voicefile<br>Timestamp with age<br>set number of Repeats<br>set repeat time Interval, in minutes<br>set page Priority<br>set page Function code |
| pages | | An alias for the "note" command. |
| pagers | | Shows the PagerCodes table (Generic Function Code feature). |
| poll | | Diagnostic that shows the peripheral cards being scanned. Press ENTER to get out of this. |
| post | <br><br><br><br>-r | Transfer office computer subscriber database changes in the subs2000.chg file to the run time subscriber data file on the paging terminal. The ZbaseW Comm Update menu item does this command for you.<br>Added in version 310J0, this switch allows direct use of ".RET" files. The correct format is:<br>+ post -r subs2000.ret |
| put | filename<br><br>file1 file2 | Put a copy of filename from office computer to paging terminal.<br><br>Put office computer file1 onto paging terminal and name it file2. Full file path names can be used. |

*Table 48: ZlinkW Commands (continued)*

| Command | Options/ Parameters | Action |
|---|---|---|
| pword | l password | Password log onto paging terminal. Must do this command first when ZlinkW-ing to paging terminal. Done automatically when ZlinkW is run from ZbaseW. |
| | p password | The p option changes password. Must be done after logging on. The correct way to change your password is to Edit Locations, ZbaseW will then automatically issue this command, otherwise ZbaseW will become confused. |
| q (or quit or ".") | | Quit ZlinkW. The ESC key will do this also. |
| ^R | | (Hold down CTRL key and press R key) Resets ZlinkW, thus will cancel a put or get command that is in progress. |
| reboot | | Reboot the paging terminal. *Stops all paging activity! It will be several minutes until the paging terminal is taking pages again!* |
| rename (or ren) | old_spec new_spec | The rename will change the name of a file or files. The original name or names is given by old_spec, which may include a path and may have wildcards in the filename in order to specify more than one file. The new name is given by new_spec, as any path is ignored just the new filename need be given. If the source and destination names do not differ then an error message will be displayed and no files will be affected.<br>After all files are processed the total number of files affected will be printed. |
| repeat | | ZlinkW command |
| resume | | Batch file command (ZlinkW local command) |
| rmdir (or rd) | directory | Remove an existing subdirectory named "directory". |
| sdb | | Display name of the active subscriber data file. |
| search | search_string filespec options | Case-insensitive search for a string through specified file(s). Filespec can contain wildcards; if no filespec is given, searches current log file. |
| | -l | Stop searching the current file after the first match is found. Each of the remaining files in the list is searched. This switch only affects searching within a file. |
| | -c | Do a case sensitive comparison, where uppercase and lowercase letters do not match. |
| | -t | Just print the total number of matches found in each file. Do not list the actual lines containing the matches. |

*Table 48: ZlinkW Commands (continued)*

| Command | Options/ Parameters | Action |
|---|---|---|
| set | filetype [filename]<br><br>filetypes:<br>options<br>trunks<br>network<br>oparam | Set operating conditions without rebooting. Filetype is as follows; filename defaults to name shown if it is not specified:<br><br>Read the options.cus file & set parameters<br>Read the trunks.cus file & set parameters<br>Read the network.cus file & set parameters<br>Read the oparam.cds file & set parameters |
| siu | <br>-a<br>-c<br>-m<br>-p<br>-q<br>-z | Displays the status of the station card(s).<br>Page Ages Pager Classes Message types Priorities SIU Queues Zones |
| snap | pagetask_name | Diagnostic for gurus. Creates a file on the paging terminal with a snapshot of the status of a given task. Find out task names with the “tasks” command. Name must match name shown in “tasks” list, except for leading/trailing spaces. |
| speed | | Diagnostic for Zetron engineers. |
| suspend | | Batch file command (ZlinkW local command) |
| tail | filename n x | Current systems: displays the tail end of filename for n lines.<br><br>Older systems or if “x” included: Makes a file on the office computer named filetail that contains the last n lines of the paging terminal file named filename. You can then type “dos type filetail” to see filetail’s contents. Useful for looking at recent events in log file.<br>Defaults: filename = current log file; n = 20. |
| tasks | <br><br>-b | Diagnostic showing information about currently executing tasks on the paging terminal.<br>Brief task list, one line per task |
| temp | | Shows temperature at paging terminal site, on some models. |
| time | <br><br>hh:mmx<br>hh:mm:ssx | See and/or set the time of day on the paging terminal. Type without options to just see the current time.<br>hours:minutesX, where X is a for am, p for pm<br>hours:minutes:secondsX, X is a for am, p for pm |
| type | filename | Types a text file from the paging terminal to the screen (same as “head -a”). |

*Table 48: ZlinkW Commands (continued)*

| Command | Options/ Parameters | Action |
|---|---|---|
| traffic | <br><br><br>-a<br>-e<br>-i<br>-x<br>-f<br>-r | Display paging activity currently happening on the paging terminal. This command is what the ZbaseW menu item View Traffic does. Press RETURN of ENTER to exit Traffic Mode.<br>include All postings<br>include only Error postings<br>Include selected postings<br>Exclude selected postings<br>Flush current traffic lines<br>Restore current traffic lines |
| vdel | | Delete a voice file or list of files. For gurus only! UNIX-like wildcards accepted. Case-sensitive; filenames must match exactly. |
| ver | | Display the version of paging terminal software that is currently running, as well as DOS and BIOS versions. |
| vftab | | Voice files associated with pages being queued in the station card are shown here. No longer used; for older versions only. |
| vget | voice_file_name dos_file_name | Copies a file from voice storage part of hard disk to DOS part of hard disk. |
| vhandles | | Shows voice file handles currently in use by voice card. |
| vls | <br><br>* | Display the voice files. UNIX-like wildcards accepted. Case-sensitive; filenames must match exactly.<br>Show all voice files |
| vput | dos_file_name voice_file_name | Copies a file from DOS part of hard disk to voice storage part of hard disk. |
| vr | | Display the status of the voice system. |
| vstats | | Show voice file system statistics. |

## ZlinkW File Operations

This is the list of "standard file operation" option switches, of the form `-X`. These work with the commands: `ls`, `copy`, `move`, `delete`, and `search`.

`f` Filter files by Attributes, Extension, Name, Size, Time. Used as "`fXRvalue`". In that string `X` is the field to filter on, `R` is the relationship to use for filtering, and "`value`" is the value to compare against.

`h` Give a screen of "help" information.

`i` Interactive mode, prompt Yes/No for each file.

`n` Non-interactive mode, process all files as a group. Asks "Yes/No" just once for a filespec.

`o` Select ordering (sort) field. Used as "`-oX`", where `X` is the field to order the list on. Choice of fields is Attributes, Extension, Name, Size, Time, Unsorted.

`r` reverse default sorting order.

The field letters and names/meanings. "C" is the standard file operation options switches (-f or -o).

| | |
|---|---|
| Ca | Attributes |
| Ce | Extension |
| Cn | Name |
| Cs | Size |
| Ct | Time |

Filter relationship symbols. Value string should match the field being tested against. Currently Filter does not work for the Time field.

| | |
|---|---|
| < | File field is greater than value. |
| > | File field is less than value. |
| = | File field is equal to value. |
| ! | File field is not equal to value. |

These switches may be combined within a single switch entry, such as -otr to sort files from oldest to newest. However the Filter option must be the last part of a switch, as it consumes the remainder of the switch string. Both "-fe!tmp -ot" and "-otfe!tmp" work, and work the same, sorting files into new to old order and selecting files whose extension is NOT "tmp". However "-fe!tmpot" will not work properly, as the "ot" will be taken as part of the extension name string (i.e. - the code is pretty simple minded, and when looking for a string for the filter value simply takes everything up to the next whitespace).

Currently there is no "wildcard" character for use within string matching, unlike DOS which allows "?" and "*". However those wildcard characters work within the filespec part of the ZlinkW file commands.

Thus "ls *2 -fn<fred2" will list all files whose name ends in "2" and whose name is less than "fred2".

## ZlinkW "cards"

The "cards" command is used to show information on the card configuration of the system. Any card specified to be loaded in config.cds will be listed by the "cards" command, if the card is not installed in the terminal or has been set to the wrong address it will show up as being "dead". The information displayed for this command will depend on the version of software running on your terminal. Prior to version 310J0, the listing will resemble Figure 50. For version 310J0 and later software the listing will resemble Figure 51.

*Figure 50: Typical Results for the "cards" Command (prior to ver-310J0)*

```
+ cards
  # Units ROM Type   Restart File          Version
  3  0  0  6  0 D- - D   0 2tnpp6c.img
  5  2  2  4  3 U P R A   0 2trnk6d5.img  2000 Series Dual Trunk V6D5,   6/09/89
  6  2  2  6  3 U P R A   0 2trnk6d5.img  2000 Series Dual Trunk V6D5,   6/09/89
  7  1  1  4  2 U P R A   0 trunk4h.img   Release V4.H,12/13/88
  9  8  8  8  4 U P R A   0 8ser8a2.img   2000 Series Multiport V8A2,   2/09/90
 17  1  1  7  1 U P R A   0 tstcode4.img  2000 Series Station test   5/08/90
 18  1  1  7  1 U P R A   0 tstcode4.img  2000 Series Station test   5/08/90
 19  1  1  7  1 U P R A   0 tstcode4.img  2000 Series Station test   5/08/90

13 LIUs    0 NIU    3 SIUs with 3 voice channels

+ cards
  # Units ROM Type   Restart File          Version
  3  0  0  6  0 D- - D   0 2tnpp6c.img
  6  2  2  6  3 U P R A   0 2trnk6d5.img  2000 Series Dual Trunk V6D5,   6/09/89
  7  1  1  4  2 U P R A   0 trunk4h.img   Release V4.H,12/13/88
  9  8  8  8  4 U P R A   0 8ser8a2.img   2000 Series Multiport V8A2,  2/09/90
```

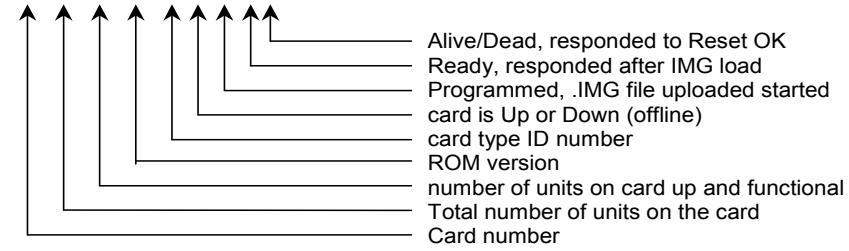
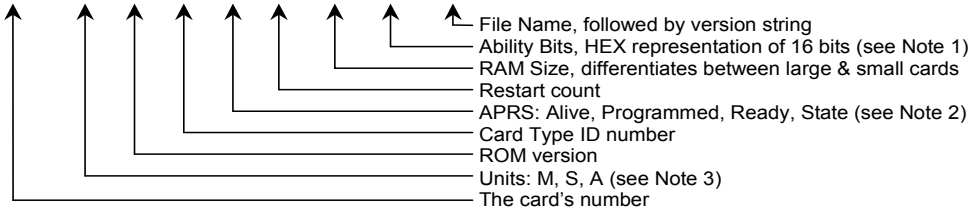

Alive/Dead, responded to Reset OK
Ready, responded after IMG load
Programmed, .IMG file uploaded started
card is Up or Down (offline)
card type ID number
ROM version
number of units on card up and functional
Total number of units on the card
Card number

*Figure 51: Typical Results for the "cards" Command (ver-310J0 and later)*

```
+ cards
 Card Units  ROM Card    Restart RAM Ability
  #   M  S A  #  Type APRS cnt  Size  Bits  File Name (Version String on next line)
  3   1  0 1  4    2  UPRA  1      0  0000  trunkcpa.img
                                           overfeed & old vc 4 chk V4.H, 11/16/93
  8   2  0 2  6    3  UPRA  1      0  0000  2tv2dtmg.img
                                           2000 Series Dual Trunk v2dtmf, 10/05/94
  10  2  2 2  6    3  UPRA  1   8000  0003  2tvida4.img
                                           2000 Series Dual Trunk vida4.img, 8/26/94 a4
  12  0  0 0  8    0  D--D  0      0  0000  2ser8a8.img

  16  1  0 1  7    1  UPRA  1      0  0000  xmtrv7d0.img
                                           2000 Series Station v7d0  2/20/91
5 LIUs  0 NIU  1 SIUs with 1 voice channels
+

+ cards
 Card Units  ROM Card    Restart RAM Ability
  #   M  S A  #  Type APRS cnt  Size  Bits  File Name (Version String on next line)
  3   1  0 1  4    2  UPRA  1      0  0000  trunkcpa.img
                                           overfeed & old vc 4 chk V4.H, 11/16/93
  8   2  0 2  6    3  UPRA  1      0  0000  2tv2dtmg.img
                                           2000 Series Dual Trunk v2dtmf, 10/05/94
  10  2  2 2  6    3  UPRA  1   8000  0003  2tvida4.img
                                           2000 Series Dual Trunk vida4.img, 8/26/94 a4
```


File Name, followed by version string
Ability Bits, HEX representation of 16 bits (see Note 1)
RAM Size, differentiates between large & small cards
Restart count
APRS: Alive, Programmed, Ready, State (see Note 2)
Card Type ID number
ROM version
Units: M, S, A (see Note 3)
The card's number

[1] Ability Bits

| for dual trunk cards | for TNPP or TAP card |
|---|---|
| bit0 = 0 (1 PCM highway) | low 2 bits = 0 (speed unknown) |
| bit0 = 1 (2 PCM highways) | low 2 bits = 1 (old speed) |

bit1 = 1 (voice or display capable) low 2 bits = 2 (new turbo speed of 1.5x)

[2] Alive = Up (card responds correctly to reset command), or Down (dead),
Programmed = P (card's run-time software was transferred), or "-" (card resets but will not load, or does not report as loaded)
Ready = R (card has loaded its run-time software), or "-"
State = Dead, Alive, Request_offline, or Offline_but_alive

[3] Units: M = total number of units on the card
S = software number in use
A = number of units up and functional

## ZlinkW “date”

(See or set the date on the paging terminal clock.)

Examples:

```
+ date            Means show me the current date on paging terminal.
+ date 1-05-89    Means set the paging terminal date to January 5, 1989.
+ date 5jan89     Means set the paging terminal date to January 5, 1989.
+ date?           Shows how to use command.
```

## ZlinkW “dos”

(Run a DOS command on the office computer.)

Example:

```
+ dos type logl0          This would print on your screen the log file
                          just retrieved from the paging terminal with
                          the "get logl0" command.  Useful for looking
                          at an event that happened in the log file.
```

## ZlinkW “faultoff”

This command deactivates the fault relay. It is used after clearing the fault condition. Please see "FaultON" on page 251.

## ZlinkW “get”

(Get a copy of a file from the paging terminal to the office computer)

This command is used to copy a file from the paging terminal to the office computer. The general form of this command is:

```
+ get <source name> <destination name>
```

The parameter <source name> is the name (possibly with a directory path prefix) of a file that is on the paging terminal disk. The parameter <destination name> is the name (possibly with a directory path prefix) of a file that will be created (or deleted and recreated) on the office machine.

Examples:

```
+ get log01
                Copy the file "log01" from the paging terminal to
                the office computer, and store it to a file of the
                same name in the current directory of the office computer.

+ get \autoexec.bat autoexec.chk
                Copy the file "autoexec.bat" from the
                root directory (designated by the backslash "\") to
                a file named "autoexec.chk" in the current directory of
                the office computer.
```

**Caution!** The "get" deletes and rewrites a file that already exists on the office computer of the same name as <destination name> without warning.

## ZlinkW "lastboot"

(Show when paging terminal last rebooted.)

The `lastboot` command shows when the paging terminal was last rebooted. Whenever the paging terminal reboots (re-starts) there will have been an interruption in paging service. The paging terminal can reboot because of a power failure, someone issuing the reboot command in ZlinkW, or someone turning the power switch on and off on the paging terminal.

In version 310J0 and later software, the command will return a message including the reason for the system reboot or restart. The last line in the following example shows this. This line is posted to the "lastboot" file. It is also shown both by the ZlinkW lastboot command and at the beginning of the next ZPAGE boot-up.

```
+ lastboot
Started at 23nov94 09:40:45a running V(zah310JJ) Nov 23 1994 08:29:44
Stopped at 23nov94 08:55:33a Program exited by operator command
```

## ZlinkW "liu"

The `liu` command is used to display information on the Line Interface Units, or trunks, in the paging terminal. It has several options that select the specific trunk information to display.

Typing the line "`liu -?`" will display a list of the options for the `liu` command. Some of the options determine which subset of liu information will be displayed, while others determine which subset of trunks will be displayed. More than one option can follow after a dash ("-"), thus the line "`liu -sg`" will activate both the `-g` and the `-s` options.

In Figure 52, the Trunk column lists the liu entries by their card numbers and unit letters. Following, is either a blank area or a 1 or 2-digit number which is the trunk group as set in the TRUNKS.CUS file. For trunks not assigned a group only blanks are shown.

**Note** Prior to version 310J0, the table produced by the liu command had a maximum of 38 entries. Also, multiport cards being used for TAP service were reported as Local Modem cards. For version 310J0 and later, the table expanded to 58 entries (to support the expansion chassis) and multiport cards used for TAP service are reported as TAP/manual.

The Mode column shows if the trunk is inbound only, outbound only, or a bi-directional trunk. The Type column identifies the line type as set in the oparam.cds file. Note that card eight, an octal serial card, appears as type local modem.

*Figure 52: Typical Results for the "liu" Command*

```
+ liu -?
      -a      Active trunks only
      -g      Display Group trunk information
      -i      Inactive trunks only
      -o      Show Override information
      -s      Show State information   (Default)

  + liu
  Trunk  Mode Type         Number    Activity    Last used
   4A       IN DID                    Free
   4B       IN DID                    Free
   6A       IN DID              0777  Ianswer     4oct90 12:25:36p
   7A       IN DID                    Free
   7B       IN DID                    Free
   8A  2    IN Local Modem  *modem*   Ibound      4oct90 12:20:49p
   8B  2    IN Local Modem            Free
   8C  2    IN Local Modem            Free
   8D  2    IN Local Modem            Free
   8E  2    IN Local Modem            Free
   8F  2    IN Local Modem            Free
   8G  2    IN Local Modem            Free
   8H  2    IN Local Modem            Free
```

The Number column is blank if there is no active call on a trunk. For dial access trunks servicing a call the subscriber ID as reported by the card will appear here. For modem access trunks and serial ports "*modem*" will be displayed when that liu is active.

The Activity column reflects the state of the trunk. When the liu is inactive it will appear as Free. An inactive liu will occasionally appear as Watched when it is being checking for any activity. An incoming call will give an activity of Ibound, followed by Ianswer when the call has been answered. Outbound trunk routing calls will have activities of Obound.

The Last Used field contains the date and time that the trunk last reported an incoming call, or was used for an outbound call. If the trunk has not been used since the last reboot then this field will be blank.

The -a switch restricts the liu display to only those trunks which are currently active. The -i switch has the opposite effect, limiting the display to only those trunks which are

currently inactive. The `-a` and `-i` switches are mutually exclusive, however either may be used with any of the other switches.

Figure 53 shows a sample session starting with one trunk active with alpha input, followed by the reporting of an incoming call, followed by the answering and processing of that call. Note that the alpha input line has been given a trunk group number, this can be helpful in separating the origins of pages on the system.

*Figure 53: Command "liu" with Switch "a"*

```
+ liu -a
  Trunk  Mode Type         Number    Activity    Last used
   8A  2   IN Local Modem  *modem*   Ianswer     4oct90 12:20:49p

  + liu -a
  Trunk  Mode Type         Number    Activity    Last used
   6A      IN DID                    Ibound      4oct90 12:26:04p
   8A  2   IN Local Modem  *modem*   Ianswer     4oct90 12:20:49p

  + liu -a
  Trunk  Mode Type         Number    Activity    Last used
   6A      IN DID              0248  Ianswer     4oct90 12:26:04p
   8A  2   IN Local Modem  *modem*   Ianswer     4oct90 12:20:49p
```

The `-o` switch is used to display trunk override information. This includes the `Trunk`, `Mode`, and `Type` fields as before. It adds the `Priority` column, which is the priority override for the trunk. Setting the priority of a trunk to anything besides "default", which displays as an "*", will force the priority of all calls on that trunk to the override priority. The `Prompt` field shows which type of prompts, voice and tone, are enabled on the trunk; this field currently has no meaning for alpha-only liu instances. The `Security` column shows whether or not security codes will be checked on calls to that trunk; passcodes for owners access and prompt setup are always checked. The `Override` field displays and destination overrides in effect for that trunk.

In Figure 54, trunk card seven has had overrides set for both of its ports. For port A the priority of all calls is being forced to level three, and only voice prompts are enabled. For port B all calls will be forced to a priority of "Breakthrough", only tone prompts will be given, and security code checking is disabled.

*Figure 54: Command "liu" with Switch "o"*

```
+ liu -o
  Trunk  Mode Type         Priority Prompt  Security   Override
   6A      IN DID             *     Both    Enabled
   6B      IN DID             *     Both    Enabled
   7A      IN DID             3     Voice   Enabled
   7B      IN DID             B     Tone    Disabled
```

The `-g` switch selects the display of trunk group summary information. For each trunk group the total number of trunks in the group is shown, as well as a break-down of the number of free, active, offline, and dead trunks. This is followed by trunk routing supergroup information, if there are any supergroups set.

*Figure 55: Command “liu” with Switch “g”*

```
+ liu -g

   Trunk  total    trunks   trunks trunks  trunks
   Group members   in use   dead   offline  free
     0      5         0       0        0      5
     2      8         0       0        0      8
```

When trunk routing supergroups have been set the list of those supergroups will follow the trunk grouping information.

*Figure 56: Switch “g” Displaying Supergroup Information*

```
+ liu -g

 Trunk  total    trunks   trunks trunks  trunks
 Group members   in use   dead   offline  free
   0      5         0       0        0      5
   2      8         0       0        0      8

    SuperGroup #  tg tg tg tg tg tg tg tg tg tg tg tg tg tg tg
          99       0  2
```

The “`liu -g`” command provides a snapshot of the trunk usage on the terminal. When used with the “repeat” command it may be useful as a method of monitoring trunk utilization over a short period of time. The trunk statistics should be used to gather trunk utilization information over a period of hours.

## ZlinkW “log”

(Show the current log file name.)

This command shows the name and size of all log files. The following command is more informative.

```
ls -lrt log*,
```

## ZlinkW “logopen”

This command lets you keep a record of a ZlinkW session. Usually, this command is not very useful to system operators (Zetron customer service personnel take advantage of it). There is one situation you might find useful. You can copy everything you see in ZlinkW to your printer via:

```
logopen PRN
```

Subsequent traffic and other ZlinkW commands will go to both the screen and the printer. To stop it, escape from ZlinkW or type: `logclose PRN`

## ZlinkW “ls”

(Display file directory)

Examples:

```
+ ls                          (Show short form directory.)
    config.cds    syslog2
    data3.bin     trunk4.img
    sdb.ptr       xmtr3.img
    subs2000.bin  zpage217.com
    syslog.ptr
    syslog1
  + ls /l                       (Show long form directory.)
  a--- 29oct86  6:24p      343  config.cds
  a--- 30oct86  1:49p    28578  data3.bin
  a--- 31oct86 12:14p       11  sdb.ptr
  a--- 24oct86  6:30p    28578  sdb2000.bin
  a--- 31oct86 12:16p       17  syslog.ptr
  a--- 31oct86  7:46p    20088  syslog1
  a--- 31oct86 12:03p     1507  syslog2
  a--- 20oct86 11:01     20480  trunk4.img
  a--- 24oct86  6:34p    25600  xmtr3.img
  a--- 29oct86  6:23p    51458  zpage217.com
```

This command is able to accept path-names as arguments and consequently can look into any subdirectory on the paging terminal system.

Example:

```
+ ls \                        (show the “root” directory)
    DOS           zclock.sys
    P_MAIN
    autoexec.bat
    command.com
    config.sys
    v.com
```

When the `ls` command is given with no arguments, it lists the current directory using the short format. If arguments are given on the command line, the display that is produced may be changed in several ways.

For each argument that is a subdirectory name, `ls` lists the contents of the subdirectory (except the `/d` option); for each argument that is a file name (but not a subdirectory) `ls` searches the relevant subdirectory and outputs the name of the file together with any other requested information.

A file name argument may contain a drive specification, a directory path (path-name), and a file name; the file name portion may contain “wild-card” characters in accordance with DOS conventions. If only a file name is given, the file is searched for in the current directory.

This program will normally sort the list of files into alphabetical order. The user may, however, request that the files be sorted by the date and time they were last modified (`/t` option); when sorting by date and time, the most recently modified (or created) file will be the first output. The user may also request that files be sorted in reverse order (`/r` option).

This option reverses the usual alphabetic sequence or reverses the most-recent-first sequence to an oldest-first sequence.

Files that are directories are always shown in upper case characters; all other files are always shown in lower case characters. If the usual alphabetical ordering is in effect, subdirectories will all be grouped before any of the other files. If the files are sorted by time stamp (date and time last modified) then subdirectories will take their places in the list according to their creation dates. It is also possible to specify that the output not be sorted at all (with the `/u` option); in this case the output will be produced in the same order that entries are found in the file directories themselves. (This is the order in which files are output by the DOS `dir` command.) If there is not at least one file name or directory argument, then the contents of the current directory are output as a default request.

The options are:

`/a` List all entries, including hidden files and directories.

`/l` Output in long format. This format shows the file attributes, the date and time the file was last modified (or created), the length of the file (in bytes) and the file name. The attributes are shown as a group of four letters beginning at the left margin. A letter, if present, means that the corresponding attribute is “on”. If a letter is not present it is replaced by a hyphen (-) character. A file may have any combination of these attributes set including all of them or none of them. The meanings of the letters are as follows:

- `a---` The “archive” bit is on. This means that the file has not been backed up by a backup utility since the file was last modified (or created).
- `-s--` The “system” bit is on. This means that the file has been marked as a system file. Usually, the only files with this bit on are the DOS kernel files io.sys and msdos.sys, located in the root directory.
- `--h-` The “hidden” bit is on. This means that the file will not be seen by the ls command unless the -a option is in effect.
- `---r` The “read-only” bit is on. The file has been marked with the read-only bit so that it cannot be inadvertently deleted or overwritten with other data.

`/u` Output in the order found in the file directories (do not sort).

`/r` Reverse the default sort order. The default sort order is alphabetic for file names or latest to earliest if sorted by the time stamp (date and time of the file).

`/t` Sort by file's last update time, instead of by name.

`/d` If an argument is a directory name, list only its name and associated information, not its contents.

`/v` Be “verbose” and output the search specification used and the number of files found.

`/h` Output a screen of “help” information.

`/c` After files are displayed, shows total number of files displayed and their combined sizes.

You can use a dash “-” instead of a “/” for options.

## ZlinkW Mailbox

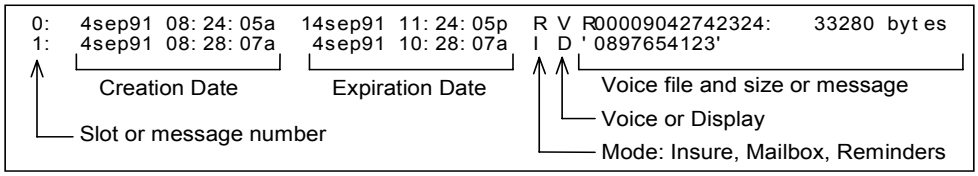
This command takes a list of subscriber IDs, such as “mailbox 555-0000 5550001 5550002”, and displays mailbox related information for each subscriber. Example:

```
     + mailbox 0

   0000 [O0000000] Nmsgs 2   Mmsgs 2   Hmsgs 1

0:  4sep91 08:24:05a  14sep91 11:24:05p  R V R00009042742324:   33280 bytes
1:  4sep91 08:28:07a   4sep91 10:28:07a  I D '0897654123'
```

The information starts with the general mailbox data:

```
0000 [O0000000] Nmsgs 2   Mmsgs 2   Hmsgs 1
ID   File Path  total msgs          'Hard' msgs, not Insure mode
```

If there are non-expired messages in the mailbox they are then listed:


0: 4sep91 08:24:05a 14sep91 11:24:05p R V R00009042742324: 33280 bytes
1: 4sep91 08:28:07a 4sep91 10:28:07a I D '0897654123'
Creation Date
Expiration Date
Voice file and size or message
Voice or Display
Slot or message number
Mode: Insure, Mailbox, Reminders

## ZlinkW “newsdb”

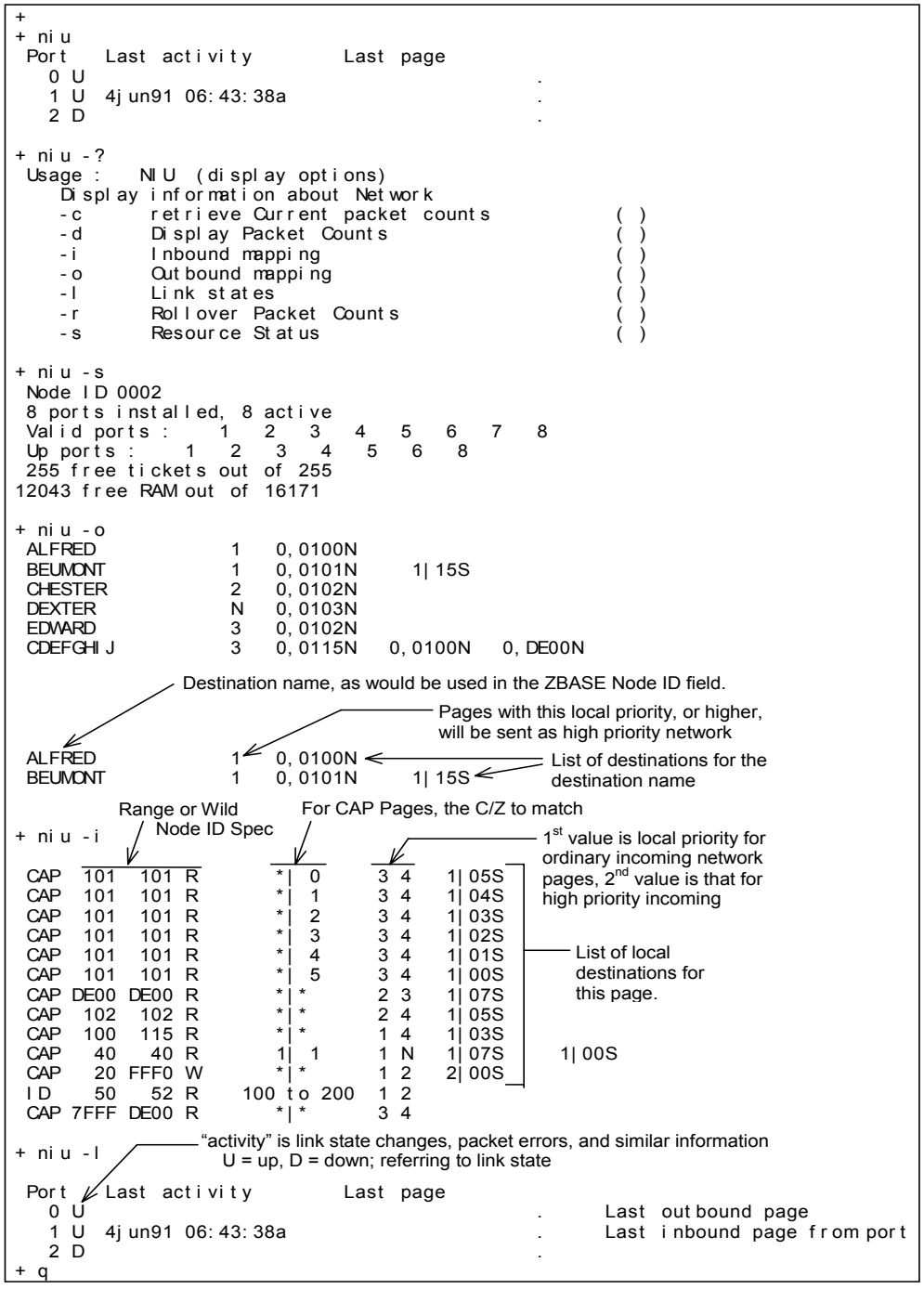
(New subscriber database command)

This command is for the transfer of a new or rebuilt subscriber database to your paging terminal. First you use the ZbaseW Other Full Rebuild menu item to create an entire run time subscriber database for your paging terminal that exactly matches your office computer subscriber data file. Then you use the ZbaseW Comm ZlinkW menu item to run ZbaseW and issue this command, “newsdb”, which causes the new subscriber database to be put onto the paging terminal as `subs2000.tmp`, then causes the old subscriber database (`subs2000.bin`) to be renamed `subs2000.old`, then causes `subs2000.tmp` to be renamed `subs2000.bin`. All this occurs with no interruption in paging service.

## ZlinkW “niu”

Figure 57 displays the output generated by the niu command when used with its various switches.

*Figure 57: The "niu" Command and Switches*


+
+ niu
Port Last activity Last page
0 U .
1 U 4jun91 06:43:38a .
2 D .
+ niu -?
Usage : NIU (display options)
Display information about Network
-c retrieve Current packet counts ( )
-d Display Packet Counts ( )
-i Inbound mapping ( )
-o Outbound mapping ( )
-l Link states ( )
-r Rollover Packet Counts ( )
-s Resource Status ( )
+ niu -s
Node ID 0002
8 ports installed, 8 active
Valid ports : 1 2 3 4 5 6 7 8
Up ports : 1 2 3 4 5 6 8
255 free tickets out of 255
12043 free RAM out of 16171
+ niu -o
ALFRED 1 0,0100N
BEUMONT 1 0,0101N 1|15S
CHESTER 2 0,0102N
DEXTER N 0,0103N
EDWARD 3 0,0102N
CDEFGHIJ 3 0,0115N 0,0100N 0,DE00N
Destination name, as would be used in the ZBASE Node ID field.
Pages with this local priority, or higher, will be sent as high priority network
List of destinations for the destination name
ALFRED 1 0,0100N
BEUMONT 1 0,0101N 1|15S
Range or Wild Node ID Spec
For CAP Pages, the C/Z to match
1st value is local priority for ordinary incoming network pages, 2nd value is that for high priority incoming
List of local destinations for this page.
+ niu -i
CAP 101 101 R *|0 3 4 1|05S
CAP 101 101 R *|1 3 4 1|04S
CAP 101 101 R *|2 3 4 1|03S
CAP 101 101 R *|3 3 4 1|02S
CAP 101 101 R *|4 3 4 1|01S
CAP 101 101 R *|5 3 4 1|00S
CAP DE00 DE00 R *|* 2 3 1|07S
CAP 102 102 R *|* 2 4 1|05S
CAP 100 115 R *|* 1 4 1|03S
CAP 40 40 R 1|1 1 N 1|07S 1|00S
CAP 20 FFF0 W *|* 1 2 2|00S
ID 50 52 R 100 to 200 1 2
CAP 7FFF DE00 R *|* 3 4
"activity" is link state changes, packet errors, and similar information
U = up, D = down; referring to link state
+ niu -l
Port Last activity Last page
0 U .
1 U 4jun91 06:43:38a .
2 D .
Last outbound page
Last inbound page from port
+ q

To just display the current network page counts use the "`niu -d`" command. This will result in a display similar to the following example:

```
+ niu -d
  source    target   count  last activity
       2       115    1098  18dec91 09:42:03a
       2       101    2742  18dec91 09:43:57a
       2       102    5634  18dec91 09:44:50a
+
```

In revision 310J0 the output of the "`niu -d`" command was changed to better display the node ID and the current Count Purge setting.

```
+ niu -d
  source   target     CAP    ID      all     bytes      last activity
    5555     0101       1     0        1        28     12jan95 04:57:35p
    000A     0101       2     0        2        56     12jan95 04:57:34p
    5555     0100     267     0      267      4808     13jan95 10:46:47a
  Stale counts purge age is 1 day
```

The network counts are returned to the office computer using the ZlinkW commands "`niu -c`" or "`niu -r`". The counts are returned in a printable ASCII format, and appear as the file `NETWORK.RET` in the ZETRON directory on the office computer. Refer to the Operations manual for details of this file.

The "`niu -c`" command returns the current counts at the time the command was issued, but does not affect the running total.

A new switch was added in version 310J0. The "`niu -e`" command shows the event settings. The output of this command will resemble Figure 58.

*Figure 58: Sample Response to "niu-e" Command*

```
 + niu -e
 Port Events
   0  (none)
   1  LinkUp ResetIn
   2  CANreply
   3  (none)
   4  LinkDown LinkUp ResetIn
   5  CANreply
   6  CANreply
   7  CANreply
   8  LinkDown LinkUp CANreply UnknownDst
 + logclose
```

The second command, "`niu -r`", performs a rollover. The current counts are saved on the Series 2000 terminal, as the file `network.cnr`, and the count table is cleared. From this point new network pages are counted into the cleared table. The saved counts are then returned as for the "`niu -c`" command. If the file transfer is successful then the `network.cnr` file will be renamed to `network.cnx`, overwriting any older `network.cnx` file.

If the file transfer is not successful, then the next "`niu -r`" command will bypass the saving and clearing of current counts, proceeding directly to transferring the `network.cnr` file to the office computer. The "`cnr`" file will not be renamed until the file transfer is successful. This prevents accidental loss of network counts data due to file transfer problems.

In revision 310J0, the "`niu -s`" command was extended to handle reporting for more than one card. The status of each TNPP card is now listed separately. The command also reports whether each card sends and/or receives pages (satellite cards can only accept inbound pages).

## ZlinkW "note"

Use the `note` command to display test and notification reminder pages. The display shows the subscriber ID for the page and the type of page (test or Reminder). Then it displays the remaining number of repeats and the interval between repeats, in seconds. After that comes the wait from the previous page in the list until this page goes out (or delay until sent for the leading page), and the total delay through the list. The last fields on the line are the voice time and/or display message length, ending with any pre-set display message. The display message does not show for reminders, which are generated each time the reminder page is sent.

The display length shown is the maximum length as set in the subscriber's ZbaseW record. This can be useful if a test page does not seem to have a proper display message generated when the `-t` or `-c` options were selected. As these options extend the length of the display message, the resulting message could be too long and end up being sent to the pager truncated, appearing as though the option was not working.

The voice time shown indicates the actual length of the selected voice file. Note that problems may arise if the selected voice file is deleted while the test page is still active. This could happen if a PageSaver file is selected and its time limit expires while the test page is active, or if a temporary voice file (one starting with an "&") is selected.

Even if there are no active test or reminder pages, the settings of the system `Reminder` parameters will be displayed. For more information on the `Reminder` parameters please see the System Configuration Files section.

```
+ note
                          Repeat                Delay
subscriber  type     remain   interval     delta     total    V    D    msg
      0251  Test        250        240        27        28        20    0251
      0259  Test         80         60        12        40        20    0259
      0260  Test        196         60         0        40        20    0260
      0257  Test        122         60         0        40        20    0257
      0779  Test        213        540        40        80    6
      0215  Test        216      10800         0        80
      0123  Rem         217        240         5        85        20

  1 Reminders   6 Test pages   max wait 85 sec
  system parameters are 7 repeats at an interval of 600 seconds,
  time displayed in Hours

? -  List ZLINK Commands
```

Typing a question mark (?) at the ZlinkW plus prompt will give a list of the current ZlinkW commands.

```
+ ?
cards    cpa      cd       chdir    chsdb    copy     cp       date
time     del      erase    df       dir      get      liu      ls
loadcard log      md       messages mkdir    move     mv       newsdb
note     offline  online   post     put      q        quit     reboot
```

```
ren       rename    rmdir     rd        sdb       set       siu       snap
tail      tasks     temp      traffic   vdel      ver       vls       vr
group     files     handles   poll      getsub    getsubs   page      lastboot
pword     heap      repeat    cls       clreos    ?

+ ? *a*     (( '?' accepts wildcards same as "ls" and "vls" ))
cards     cpa       date      erase     loadcard  messages  rename    snap
tail      tasks     traffic   handles   page      lastboot  heap      repeat
```

**Note** The loadcard, offline, online, and handles commands are not yet implemented. Do not use these commands.

## ZlinkW “page”

Sending a test page using the `page` command starts a page that will repeat a specified number of times at a specified interval or repeat rate. Options for the `page` command include setting the number of times the test page will be repeated, which is independent of any repeats set within the subscriber record. The interval between repeats may also be specified, as can the page's priority, and the display or voice message used with the page. More than one test page may be active at any given time, however there may be only one test page for each subscriber ID.

The pager that is to receive the test page must have a subscriber record defining it, the `page` command uses the subscriber record to generate the test page. The subscriber ID may be entered with or without a hyphen (“-”) and need not have leading zeros. Thus “`page 0-004`”, “`page 0004`”, and “`page 4`” all refer to subscriber ID four. However the form in which the subscriber ID is entered will affect the default display message.

The simplest example of starting a test page is just the command line “`page 999999`”, where the “`9999999`” is the subscriber ID for pager to get a test page. Once the test page is started ZlinkW is available for further commands. You may issue more test pages or other ZlinkW commands, or quit ZlinkW. The test page will repeat until it is “killed” by a ZlinkW command, or until it “counts out” after reaching the specified number of repeats. In either case a message is posted in the log file stating the reasons the test page stopped repeating. To stop a test page before it counts out you can type “`page 999999 -k`”, again the “`999999`” is the subscriber ID of the test page you wish to “kill”.

*Figure 59: Switches for the “page” Command*

```
+ page -?
PAGE  -  Send a test page
 Usage :   PAGE  sub_ID  (option switches)
  sub_ID is the Zbase subscriber to page. Dashes within the ID number are OK.
  (option switches) are :
  -k      Kill test page
  -a<num> Align page times
  -c      append Counter to msg                    False
  -d<str> set Display message                      <subscriber ID>
  -v<str> select Voicefile                         <voice_test>
  -t      Timestamp with age                       False
  -r<num> set number of Repeats
  -i<num> set repeat time Interval, in minutes
  -p<c>   set page Priority
  -f<num> set page Function code
```

The message or messages used with the page depends on the subscriber record setting and several options to the `page` command. For records with a non- zero display message the default message is the subscriber ID as typed on the `page` command line. For records with non-zero voice time the default message will be the Zetron supplied "test_page" message, which may be re-recorded by the system operator. However these default messages may be changed using command options.

The `-d` option can be used to set the display message to the string of characters following the `-d`, as "`page 123-4567 -dTestPage`". The display message may be separated from the "`-d`" by a blank space, but the message itself can not have blanks within it. Thus "`page 111 -dTestPage`" and "`page 111 -d TestPage`" both are legal, while "`page 111 -dTest Page`" is not.

However, you CAN include blanks in a message if you surround it with double quotes. For example:

```
page 123 -d "A message with spaces"
```

**Note** You must have a space between the -d and the quoted message.

Also, you can now page from a file - put the message into a file, put the file to the paging terminal using the "put" command, then specify the file with the "`-d@`" method; for example:

```
put myfile
page 123 -d@myfile
```

While most messages will display as they are written into their files, there are two possible exceptions to this. Some byte values may not display as expected due to the fact that TAP outdial destinations generally expect 7-bit data. In addition, the value "NUL" (00h) is not displayed.

The `-v` option can be used to select the voice file to be played as the voice message for test pages with voice. Any voice file, as shown by the `vls` command, may be selected. However if a voice file is deleted while the test page is still active warning messages will be posted in the log for each repeat of the test page. Files that are expected to expire, such as temporary files beginning with a "&" or mailbox voice files starting with "I", "R", or "M", are likely to be deleted.

**Note** The switch "-v" only works if the system has the voice prompts option.

The `-c` switch, when used with a display pager, will append a "counter" to the end of the display message. This is a number that starts at one and increments with each repeat until the test page is killed or counts out.

**Note** The switch "-c" only works if the display message is entered from the command line.

The ZlinkW "note" command may be used to list the currently active test pages.

Examples:

Page a display pager 100 times with a counter on the display:

```
page 1234567 -c -d9876543210 -r100 -i1
```

Page a voice pager once with its own custom paging/insurance voice prompt:

```
page 5551212 -vp5551212 -r0
```

The `-a` option attempts to Align the test pages with the real-time clock. The range is 1 to 30. "`-a15 -i60`" would put out pages at 15 minutes after the top of each hour.

In version 310J0 and later, the alignment switch (-a) uses the standard hours, minutes, and seconds format (HH:MM:SS) for entering the paging time. The time may be entered in either the 24-hour format or the 12-hour format with trailing "a" (AM) or "p" (PM). If the alignment time entered is earlier in the day than the current system clock time, ZPAGE assumes that the test page should be sent out at the entered time the following day. For example, if the system clock reads 2:05 P.M. and you enter "`-a2:00p`", then the test page will be sent at 2:00 P.M. the following afternoon.

The `-r` option sets the number of test pages to send. If this option is not given, the value of the Reminders setting in the `options.cus` file is used (factory default is 7). So if you want only one test page, be sure to specify `-r1`. The range was one to 65000 in software versions prior to 310J0. In version 310J0 and later, the maximum number of repeats for test pages is two billion.

If you start up many test pages, then decide you do not want the pages to continue, use the `-k` option. For instance, if you did "`page 123 -r1000`", to kill the rest of the test pages do "`page 123 -k`". If you have a number of test pages to kill, you can use this format to kill several at once: "`page -k 555-1212 123-4567 876`".

The `-i` option sets the interval between test pages if more than one is specified. If this option is not given, the value of the ReminderTime setting in the `options.cus` file is used (factory default is 15 minutes).

When using software versions prior to 310J0, if you want a 1-minute interval, specify `-i1`. The range is 1 to 1000 (almost 17 hours). Due to this limit, it cannot currently be set to go out once a day.

When using software version 310J0 and later, the interval between pages may be set to any value between one second and 3,600,000 seconds (1000 hours). The following examples show how to enter time periods in the new format.

```
+page 1234 -i12:34:52    ;12 hours, 34 minutes, 52 seconds
+page 1234 -i12:0:0      ;12 hours
+page 1234 -i12          ;12 minutes
+page 1234 -i0:12        ;12 seconds
```

You can suppress the usual voice message for a voice pager by putting just `-v`, with no name, at the end of the command line. Likewise, you can suppress the usual display

message for a display pager by putting just `-d`, with no name, at the end of the command line.

The `-p` and `-f` options let you override the database settings for the subscriber's `Priority` and `FunctionCode` settings, respectively. The priority value is the same as used in the database, 1-4, N, or B, e.g. `-p4` for priority 4. The function code value is as shown in the traffic or logs; it is the same as the database values except for POCSAG - for POCSAG use values 0 to 3 corresponding to database values 1 to 4.

The `-t` option adds an age indication to the display message. The format is "nnn" where nnn is 000 to 999. If `ReminderAge` in `options.cus` is set to Hours (the default), this number is hours. If it is set to Minutes, this number is minutes. The number is the time from when the "page" command was given in ZlinkW.

## ZlinkW "reboot"

**(Reboot the paging terminal.)**

Use this command to reset the paging terminal and begin running new version of paging system software. (It does essentially the same thing as turning the terminal off and on again.)

> ⚠ **Caution!** When you "reboot", the Terminal stops everything and restarts all software. Any paging transactions currently in process are terminated. Telephone callers connected at the time of the reboot are disconnected. This command is intended for service use to initiate new software.

## ZlinkW "repeat"

```
+ repeat
Repeat  -  repeat ZLINK commands until <Return> pressed

  Usage :  Repeat  commands
    'commands' is one or more ZLINK commands separated from
    each other by ';' or '\'
```

The `repeat` command is used when you wish to execute the same ZlinkW command over and over. It expects that there is an ANSI display driver installed. This is the `ansi.sys` or similar file that is specified in your `config.sys` file, and normally is set up as part of the ZbaseW installation procedure.

The repeat command first does a screen clear, which wipes out any old data on the screen. It then executes each ZlinkW command that was typed on the same line as the repeat command, starting with the leftmost command. After the last command has been executed this sequence starts over. The command or commands will be repeated until the **Enter** or **Return** key is pressed, or until the **Esc** key is used to terminate the ZlinkW session.

The `repeat` command should not be used with the `traffic` command. No harm will be done, but as the `traffic` command also watches for a **Return** key to terminate it the results may be confusing. If you do type "`repeat traffic`" you may need to quickly press **Return** several times in a row in order to leave the traffic command. Also the "repeat" command should not be used with the `page` command, as this will result in rapid, repeated, restarting of the specified test page. This can create large transmitter delays as dozens or hundreds of test pages are sent to the station card within a very short time.

One example of uses for the repeat command is the following line:

```
repeat siu -mc; liu -g
```

This will display the messages type, alert, voice, and display, batched on each station card, followed by the number of pages for each pager format on the station cards, followed by the trunk group usage information. This information will be updated every few seconds, the exact rate depending on the number of trunks and station cards, and if local port or modem access is being used. In other words it provides moment to moment overview of the activity on the paging terminal.

There are three commands that are generally useful only with the repeat command:

```
cls     Clear the whole screen.
        Example:  repeat cls; liu -q

clreos  Clear from current cursor position to end of screen
        (note: most ANSI.SYS drivers don't properly support this)

cr      Carriage return - insert extra blank lines.
        Example:  repeat cr; cr; cr; liu; cr; cr; siu
```

## ZlinkW "search"

This allows a file or files to be searched for lines containing a string, and all lines that match are printed to the display. The search is case insensitive, and the string cannot have blanks in it. The command uses the same file wildcards and switches as copy does. The following entry will show you the heap status at the beginning of the log files, in time order.

```
+ search heap log* -ot
```

As another example, this next entry will show you all the activity for telephone number 820-6363 in the current log.

```
+ search 820-6363
```

And as a final example, the following will show you all the Minimum... lines in the customer's options.cus file.

```
+ search minimum options.cus
```

There is no way to stop search once it starts. Entering the following would be a disaster, since it will print out almost all the log file lines, from all the log files.

```
+ search - log*
```

Even hanging up and calling back will not stop it in older versions. As of Version 310h1, hanging up will stop it in a short time.

In version 310J0 three switches were added to enhance the `search` command. The switch `-l` was added to stop searching of the current file once the first match is made. The switch only affects searching within a file and each remaining file in the list is searched. The format for this switch is:

```
+ search 820-6363 -l
20070 C:\ZDIR\log00search found 2 matches
```

The switch `-c` was added to allow case-sensitive comparisons to be made. The format for this command is:

```
+ search "Hi John" -c
20020 C:\ZDIR\log01search found 1 matches
```

The switch `-t` was added. This switch returns only the total number of matches found in each file. It does not list the actual lines containing the matches.

```
+ search 820-6363 -t
20030 C:\ZDIR\log03search found 4 matches
```

## ZlinkW “siu”

The `siu` command is used to observe the current state of the Station Interface Units, i.e. the transmitter controllers.

```
+ siu -?
 Usage :   SIU  (display options)
    Display information on transmitter channels
    -a      Page Ages
    -c      Pager Classes
    -m      Message types
    -p      Priorities
    -q      SIU Queues (default)
    -z      Zones
```

The `siu` option `-c` is used to select pager classes, the total number of pages for each general type of pager that are batched in the station card. As there are two differing speeds of POCSAG pagers, which are batched separately, they are shown as “POC” for normal or slower POCSAG and “poc” for 1200 baud.

```
  chan port status  Total   2T 5/6 HSC GSC POC poc NEC MLT
    1   19A  Ready     20     4   0   0   0   0  16   0   0
    2   18A  Ready     17     1   0   0   0   0  16   0   0
    3   17A  Ready     19     3   0   0   0   0  16   0   0
```

The option `-a` is used to display page Ages, the age of the oldest page for each zone. This time is displayed in minutes since the page was batched to the station card. Note that a page that is waiting in repeat delays or a page that is actively playing, such as a long voice page, will continue to “grow older” until it has been completely transmitted. The page will be checked by the “age” option so long as it is batched in the station card.

```
 chan port status  Total    ____Oldest By Zone_____________________________
   1   19A  Ready     20   14  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0
   2   18A  Ready     17    2  0  0  0  0  0  0  0  0  0  0  0  0  0  0 14
   3   17A  Ready     19   14  0  0  0  0 14  0  0  0  0 14  0  0  0  0  0
```

To display pages grouped by Message type use the `-m` option. This breaks the batched pages into three main sections. Pages with no messages are displayed under the “Alert” heading. Pages with display messages are shown under the “Display” heading. Pages with voice messages are displayed under the “Voice” heading. Please note that those pages

with both display and voice messages will be counted under both headings. For each category a “percentage” column, marked with a percent sign, indicates the percentage that the particular message type, alert, display, and voice, are of all pages batched in that station card.

The total number of characters in all batched display messages is shown in the “chars” column, while the sum of the play time of all the batched voice messages is shown under the “seconds” column.

These totals and percentages do not take into account reductions in play time possible for group calls with voice to some pager types, nor the similar reduction for group calls to some display pager types. Also the effect of repeat pages is not taken into account.

```
Total    -Alert-    --- Display ---  ---- Voice ----
 chan port status batched   pages  %   pages chars  %   pages seconds  %
  1   19A  Ready      20       0   0     16    16  80      4      48   20
  2   18A  Ready      17       0   0     16    16  94      1      12    5
  3   17A  Ready      19       0   0     16    16  84      3      36   15
```

Batched and queued pages can be displayed totaled by their priorities. Queued pages, not yet batched into the siu, have all normal priority pages lumped together into a single sum under the “Nrml” heading. Talkback pages waiting for the siu are listed under the “Tbk” column, which will be blank if talkback is not an option on that siu. The higher priority pages, of type Next Out and Breakthrough, are listed under the “Next” and “Brk” columns. If either of these columns are non-zero then no pages from the talkback or normal queues will be processed, they will stack up until all waiting (queued) nextout and breakthrough pages have been batched.

Batched pages report the priority distribution of those pages actually batched into the station card. The fields have similar meanings as the queue fields, except that normal priority pages have each priority broken out from highest to lowest priority.

```
station           ----  Queued ----   ------  Batched  ------
 chan port status   Brk Next Tbk Nrml   Tot Brk Nxt Tbk  Nrml
  1  19A  Ready      0    0        0    20   0   0       0  16   4   0
  2  18A  Ready      0    0        0    17   0   0       0  16   1   0
  3  17A  Ready      0    0        0    19   0   0       0  16   3   0
```

The number of pages batched to each zone may be displayed. The zone totals start with zone zero on the left, ending at zone fifteen at the right.

```
chan port status  Total     ____By Zone_____________________________
  1   19A  Ready     20   20  0  0  0  0  0  0  0  0  0  0  0  0  0  0
  2   18A  Ready     17   16  0  0  0  0  0  0  0  0  0  0  0  0  0  1
  3   17A  Ready     19   17  0  0  0  0  1  0  0  0  0  1  0  0  0  0
```

The default display, also selected by the `-q` for queued option, shows the total number of pages batched on the station card, followed by the number of pages waiting to be batched in each type of queue. Except for talkback, the queues normally have one or no pages in them, only under heavy traffic conditions with extreme transmitter loading do the batch-waiting queues get used. Also displayed is the current state of the station card and its voice channel, as well as the time of completion of the most recent page on that channel.

```
channel port   status   voice    Bat Nrml Next  Brk Tbk
    1    19A    Ready    Active   20    0    0    0      3oct90 03:12:46p
    2    18A    Ready    Idle     16    0    0    0      3oct90 03:14:05p
    3    17A    Ready    Idle     18    0    0    0      3oct90 03:14:05p
```

## ZlinkW “tail”

**(See or get the tail end of a file.)**

This command will return the last n lines of a file. The default is 20 lines. It is particularly useful for looking at the end of the current log file when something unexpected has just occurred on your channel.

Example:

```
+ log                    See the latest log file.
+ tail log01 20 xx       Assume log01 was seen with log command.
+ dos type filetail      See returned log file lines.
+ tail log01 50 xx       Assume weren't able to see quite far enough
                         into the past.
+ dos type filetail      See returned log file lines.
Ctrl+S                   Stops the item of interest from scrolling out
                         of sight.
Shft+PrtSc               Print out on printer the interesting
                         information you are seeing.
```

General form:

```
 + tail filename lines xx filename is file to get tail of
                          lines is number of lines to get
                          xx says to create filetail on PC; otherwise,
                          just shows to screen.
```

## ZlinkW “time”

**(Set the time of day as  hh:mma (or mmp))**

Examples:

```
+ time              Just see what time the paging terminal thinks it is.
+ time 11:15a       Set time to 11:15 am.
+ time 11:15p       Set time to 11:15 pm.
+ time ?            Shows how to use it.
```

## ZlinkW “traffic”

The `traffic` command allows the monitoring of system traffic posting via ZlinkW. This display is similar to the log file postings. The `traffic` command has several options; these allow the selection of a subset of posting types.

```
+ traffic -?
    -a      Include all postings                    (value is      )
    -e      Include only error postings             (value is      )
    -i<str> Include selected postings               (value is <._>)
    -x<str> Exclude selected postings               (value is <>)
    -f      Flush current traffic lines             (value is      )
    -r      Restore current traffic lines           (value is      )
```

The `traffic` command defaults to the setting found in the options.cus file, which defaults to “`traffic -i._`”. This shows only “sent” pages, which is similar to V300 “batched”, and failed pages. Note that successful pages start with a blank in the leftmost column, which is represented in the switches `-i` and `-x` by a underscore “_”. Actual blanks, as typed using the space bar, can not be used within the `-i` and `-x` switches. See ticket posting format for the prefix characters.

When you type the `traffic` command, or select the "Traffic" option from the ZbaseW menu, the first line displayed may read "`- ... data lost ...`". This is simply indicating that some traffic logging was not seen by you. If this message is displayed while you are in traffic it indicates that the system is performing log postings faster than the traffic command can display them. The postings are not lost; they simply are missed by the traffic display. This may occur and busy systems when viewing traffic over the modem connection.

```
+ traffic
- ... display overrun ...
      0256 page sent        12:10:59p  2      6AL    1|00S P1  00000256 D  1 7
      0263 page sent        12:11:02p  2      6AL    3|00S P1  00000263 D  1 7
      0263 page sent        12:11:02p  2      6AL    2|00S P1  00000263 D  1 7
      0263 page sent        12:11:03p  2      6AL    1|00S P1  00000263 D  1 7
      0777 owner succeeded  12:12:03p  1      6AL
      0777 page sent        03:12:46p  1      6AL    2|15S 2   000 P123
      0777 page sent        03:12:46p  1      6AL    1|00S 2   000 P123
```

The next set of log entries, or traffic reports, is a set of pages from a serial port access. Note that as there is no number called to start the transaction the subscriber ID is posted as `*modem*`; however the individual pages resulting from alpha pages have their subscriber numbers posted. The alpha pages were done on the "A" port of a octal serial interface card addressed as card 8, the source is posted as "8AA" with the second "A" representing the "Alpha" mode of this input device.

```
*modem* alpha # in prgrs 12:13:26p  *      8AA
      0777 page sent        12:13:35p  1      8AA    1|00S 2   000 P123
      0777 page sent        12:13:35p  1      8AA    2|15S 2   000 P123
      0006 page sent        12:13:38p  B      8AA    1|00S 5   00054321
      0004 page sent        12:13:45p  3      8AA    1|00S P0  00910263 D  1 4
      0004 page sent        12:13:45p  3      8AA    1|00S P0  00910263 D  1 4
      0003 page sent        12:13:48p  2      8AA    1|00S P0  00910263 D  1 3
      0003 page sent        12:13:49p  2      8AA    1|00S P0  00910263 D  1 3
      0002 page sent        12:13:52p  1      8AA    1|00S P0  00910263 D  1 2
      0002 page sent        12:13:53p  1      8AA    1|00S P0  00910263 D  1 2
   *modem* alpha # in done  12:14:01p  *      8AA total of 6 transactions
      0001 page sent        12:14:28p  0      8AA    1|00S P0  00910263 D  1 1
      0001 page sent        12:14:28p  0      8AA    1|00S P0  00910263 D  1 1
```

The following is a modem call to an alpha access number, marked with status "A" in ZbaseW. Note that this is very similar to the transaction on a serial card, except that the ID number is used instead of `*modem*` and that the transaction source type is "L" for "LIU" instead of "A" (Alpha).

```
      0555 alpha # in prgrs 12:15:25p  0      6AL
      0002 page sent        12:15:44p  1      6AL    1|00S P0  00910263 D  1 2
      0002 page sent        12:15:45p  1      6AL    1|00S P0  00910263 D  1 2
      0001 page sent        12:15:45p  0      6AL    1|00S P0  00910263 D  1 1
      0001 page sent        12:15:46p  0      6AL    1|00S P0  00910263 D  1 1
      0555 alpha # in done  12:15:53p  0      6AL total of 2 transactions
```

## ZlinkW "vls"

**(Show the contents of the voice file directory)**

This command outputs a listing of the files resident in the voice portion of the fixed disk. Files with names beginning with the "&" character are temporary files; temporary files are created and deleted as voice pages are processed by the paging terminal.

It is possible to ascertain some information about the origin and destination of the voice message in a temporary file by examining the file name. The meanings of the digits in the voice file name are described in the following subtopics.

### Temporary Files

```
&ttttttssssssppu

where   &     = "temporary file"
        ttttt = 5 digit serial number (00000 - 65535)
        ssssss= 6 digit subscriber ID number
                (the last 6 digits of the subscriber
                number from the database)
        pp    = 2 digit trunk port address
                (usually the same as the card slot number)
        u     = 1 digit trunk unit number
                (always 0 for single trunk 702-9037,
                 0 or 1 for dual trunk 702-9117)
```

Temporary files will normally be resident on the system for a few seconds to a few minutes. If any temporary files are seen that have “old” dates (say several hours or several days old) then something has happened that caused the paging terminal to record a voice message and fail to delete it. A typical cause is calls to wrong numbers.

### PageSaver Files

PageSaver files, files that are made due to a pager being in Insure, Notify, or Mailbox mode, are named in the following manner:

```
Cttttddddddhhmm
where   C    = I for Insure, R for Notify, & M for Mailbox, mode pager
               was in when file was made
       ttttt = ticket number, 00000 to 65535
       ddddd = day of expiration, number of days since Jan. 1 1980
          hh = hour of expiration, 00 to 23
          mm = minute of expiration, 00 to 59
```

### System Files

Other files are permanent voice files such as files containing prompts. These file names may contain up to 15 characters. System voice prompt files have description names such as "main_menu". See the "Voice Prompts" section in 2000 Series Paging Terminals Operating and Programming Manual (Part No. 025-9034-001).

### Client Greeting (Custom Prompts)

Custom prompt files start with one of three letters followed by the customer’s telephone number.

```
p5551234  Paging/insure greeting for customer id 555-1234
a5551234  Announcement greeting
s5551234  Save (mailbox/notify) greeting
```

## ZlinkW “vget”, “vput”

**(Transfer files between Voice Storage and DOS)**

Refer to *Maintenance* on page 205, for information on using these commands.

## ZlinkW Command Switches

Several general command switches were added to ZlinkW with the release of ZPAGE version 310J0. They are presented here.

## Date & Time Switches

ZlinkW file operator commands, such as `del`, `copy`, and `search`, now support file date and timestamp display. The new file operator switch, `-d`, has three sub-switches that set the options for displaying the file details. Table 49 lists all the possible details switch combinations. Table 50 list the default settings of size and timestamp reporting for several common commands.

*Table 49: File Date, Timestamp, and Size Display Switches*

| Switch | Description |
|---|---|
| -ds | show the file size in bytes |
| -dt | show the file timestamp |
| -dts | show the file size and timestamp |
| -dst | same as “-dts” |
| -dn | do not show either size or timestamp |

The following are examples of each switch.

```
+ search fdfgf log00 -ds
40060 C:\ZDIR\log00;The file size is 40060 bytes.
+ search fdfgf log00 -dt
8nov95 12:19 C:\ZDIR\log00;The file date/time is 11/8/95
            ;@ 12:19 p.m.
+ search fdfgf log00 -dts
8nov95 12:19 40060 C:\ZDIR\log00;The file size is 40060 bytes and
            ;it's dated 11/9/95 @ 12:19 p.m.
+ search fdfgf log00 -dn
C:\ZDIR\log00
```

*Table 50: Default Values for File Operator Commands*

| File Operator | Query* | Size | Timestamp |
|---|---|---|---|
| copy, cp | Off | On | Off |
| del, erase, rm | On | On | On |
| move, mv | Off | Off | Off |
| rename, rn | Off | Off | Off |
| search | Off | On | On |

* Query refers to whether or not the command asks if you really want to perform the operation. For instance, the delete command asks "are you sure?" before it will erase any files.

This ties in with the ZlinkW interactive query mode - where the system asks if it is okay to process the current file. The interactive mode now has a third option to the query - `End`.

This response allows the user to exit immediately, without having to respond to the question again for each individual file.

### Switch Stacking

ZlinkW command switches can now be stacked in any order. Previously, some of the switches would not stack. If you entered multiple switches all but the first switch would be ignored. Good examples of the new protocol are the `-dts` and `-dst` switches for file operator commands. Refer to Table 49.

### Getting Help

To access help on the syntax and usage of a specific ZlinkW command, simply type the name of the command (or any of its aliases) followed by a question mark switch (-?). The information available for that switch will be displayed.

Entering the question mark alone (?), or typing “help” at the “+” prompt will display a summary of all ZlinkW commands.

## Log Posting Format

*Figure 60: Example of Log Posting Format*

```
  Subscriber               Time      Priority      Destination
     ID    Result          Completed      Source           Capcode
  465-7190 Gpage sent        10:50:03a 2      8 AL    1|02S P0  01060007  D 11 034-4455 93
  465-7191 Gpage sent        10:50:08a 2      8 AL    1|02S D   00000140  D 11 034-4455 93
  465-7265 page sent         10:50:22a 2      7 AL    1|00S P0  01080017  D  8 758-8400
  465-7002 alpha # in prgrs  10:51:43a 1      8 AL
  465-7039 page sent         10:51:44a 2      7 BL    1|00S P0  01060021  D  8 444-1432
  465-7021 page sent         10:51:55a 2      8 AL    1|00S P3  01040004  D 66 ERNESTINE GEROGIANNA  PLEASE
  465-7002 alpha # in done   10:51:55a 1      8 AL total of  1 transactions
  465-7181 page sent         10:52:06a 2      7 AL    1|02S D   00000078  D  8 650-0169
  465-7181 page sent         10:52:13a 2      7 AL    1|00S D   00000078  D  8 650-0169
  465-7010 reminder sent     10:52:31a 4      7 BL    1|00S D   00000093  D  7 002 002
  465-7010 ntfy sent         10:54:42a 4      7 BL    1|00S D   00000093  D  7 003 002
  465-7021 page sent         10:56:02a 2      8 AL    1|00S P3  01040004  D 12 123-4567 890
  465-7228 page sent         10:56:04a 2      7 AL    1|00S P0  01060025  D  8 449-9861
  465-7228 page sent         10:57:40a 2      7 BL    1|00S P0  01060025  D  8 444*0404
+ 28may91 11:00:03a  : 4 statistics flushed to disk  .
  465-7060 page sent         11:01:48a 2      8 AL    1|02S 2   000  B105 V 13
  465-7060 page sent         11:02:07a 2      8 AL    1|00S 2   000  B105 V 13
  465-7115 page sent         11:03:22a 2      7 AL    1|00S D   00000136  D  8 425-2447
  465-7285 insure no msg     11:04:03a 2      8 AL    1|00S
  465-7285 insure sent       11:04:33a 2      7 BL    1|00S P0  01050035  V 23
  465-7285 insure sent       11:04:38a 2      7 AL    1|00S P0  01050035  D 10 231-4025 *
+LINK CONNECT Modem at  28may91 11:04:59a  for port  1
  465-7189 page sent         11:05:02a 2      8 AL    1|00S P0  01060031  D  8 671-1515
```

The first, leftmost, character of a log posting line is the posting prefix. It indicates the general status of this line. If the line is a comment or error then there is no fixed format for the reminder of the line.

The next field is the subscriber ID for the posting. For serial and modem only lines this will be `*modem*`.

The next two fragments of log information are the call or action class and result. They report the type of call and the final result of that call, for some types of calls there may be additional postings.

The time of completion of the action is the next field. This is the time the page actually was transmitted, or the caller hung up for owners access and similar calls.

The time is followed by the priority of the call. This is a single character that matches the ZbaseW priority field. It may be different than the subscriber's normal priority if the posting is part of a group or if the trunk has a priority override value set.

The source of the posting is what caused this effect to start up. For normal calls this is the trunk identifier, which is displayed as card number followed by the port letter. The rightmost letter in this field is the class of the source. For normal calls this is an "L", for Alpha input it would be an "A". Reminder and test pages will just have a "C", for CRON, as their source.

The destination for the page is next. This is the channel number, followed by a "|", followed by the zone as a two-digit number with leading zeros. For pages with repeat values set the channel number will be prefixed with the repeat count and an "x".

The pager description follows the destination. This is actually two fields in one. The first is the page type, 2-tone, 5/6-tone, GSC, POCSAG, HSC. The second field is the pager function code as 1 or 2 digits, or blank for pagers without function codes. In the case of 5/6 tone pagers, it is 0 or 1 meaning the pager's first or second address.

The pager capcode follows as an eight-digit field, with leading zeros.

The right side of the posting is used for message types and times. A "V" is Voice, followed by up to three digits of voice time in seconds. A "D" is Data or Display, followed by up to three digits reporting the number of display characters in the display message. Display messages also have the leading characters of the message text logged.

## Paging Format Letters

As of ZPAGE version 310j0, some of the paging format letters that post in the logs have been updated. The changes are summarized in Table 51.

*Table 51: Changes in System Log Posting of Capcode Letters*

| Pager Format | Old Letter | New Letter |
|---|---|---|
| POCSAG | | |
| 512 baud | P | P |
| 1200 baud | P | p |
| 2400 baud | P | Q |
| Golay | | |
| type IIA | G | T |
| all other types | G | G |
| NEC D3 | D | N |
| DP6000 | not supported | D |

Each of the three POCSAG pager types are batched separately, so it is important to see them log separately. The two Golay pager types also batch and log separately. Support for the DP6000 pager format was added, as well.

The changes allow for more complete log information about POCSAG and Golay pager subtypes. This improvement will aid diagnosis of batching problems. In addition, the POCSAG, Golay, and NEC D3 letters now match those used in a TNPP capcode page packet.

All supported pager formats and their corresponding log posting letters are summarized in the following table.

*Table 52: Log Posting Capcode Letters*

| Pager Format | Letter | TNPP notes |
|---|---|---|
| 2-tone | 2 | |
| 5/6-tone | 5 | |
| Blick | B | |
| DP6000 | D | not supported; D=DTMF |
| Golay<br>type IIA<br>all others | <br>T<br>G | |
| HSC | H | |
| Multitone | M | uses “4”, “V”, & “6” |
| NEC D3 | N | |
| POCSAG<br>512 baud<br>1200 baud<br>2400 baud | <br>P<br>p<br>Q | |
| Quick Call 1 | Q | not supported |
| RDS | R | |

## Overdialed And Call Recycle Posting

Log posting of trunk types has been expanded to indicate overdialed and call recycled numbers. A trailing “O” in the trunk column of the log report indicates overdialed and a trailing “R” indicates recycled. This change is useful for traffic monitoring applications.

For example, a trunk might be reported as “12AO”, meaning that the page was overdialed on (DID) trunk 12A. In addition, if the call recycle option were activated after the first page was entered, the second (and any later pages) would post as “12AR”. In previous ZPAGE versions, both of these calls would post as “12AL”.

## New Destination Type (Log +)

A new log destination type was created. The new destination, specified in the `network.cus` file, is labeled “Log+”. The new label does not actually send a page, it just log posts for diagnostic purposes. Here are several examples of the new log postings:

```
Inbound   CAP   1212 * *  1 3   Log+
Inbound   CAP   3333 * *  1 3   1/OS Log+
Outbound   TEST 2  Log+
```

The first example shows a log of just the TNPP destination. The second example shows a page and an extra log. The third example has a dummy destination, and it only log posts.

The new “Log+” destination is useful for observing the delay in sending a page. In addition, it makes it easy to check capcodes on TNPP traffic that you do not want to page locally.

## “set” Command

The log file now posts all ZlinkW `set` commands. This allows the system operator to check on any system configuration changes. Below are some examples of the `set` command, their results, and the corresponding log posts. (The first line is typed at the plus (+) prompt, and the second line is the system response.)

Example 1

```
+ set options
Setting options with file 'OPTIONS.CUS'
+
```

The log file reporting for this command would be:

```
+19jan96 04:07:23p SetOptions processing file 'OPTIONS.CUS'
+19jan96 04:07:25p SetOptions processing of file 'OPTIONS.CUS'occurred
```

Example 2

```
+ set network
Setting network with file 'NETWORK.CUS'
+
```

The log file reporting for this command would be:

```
+19jan96 04:06:50p SetNetwork processing file 'NETWORK.CUS'
+19jan96 04:06:52p SetNetwork processing of file 'NETWORK.CUS'occurred
```

If no valid commands were found in the file being processed, the second line (in either example) would have reported “did not occur” instead of “occurred”. Likewise, if the file did not exist, the second line would have reported “could not be done” instead of “occurred”.

Please note that the `set` ASP command has not changed.

**Note** Additional information concerning the “set” command may be found on page 320.

# Posting

*Table 53: Posting Prefix Definitions*

| Prefix | Condition or Class |
|---|---|
| (blank) | posting successful ticket, such as page sent. |
| . | posting failed ticket, such a call to an invalid subscriber ID, no message entered when required, and so on. |
| + | comment or informational line, such as day rollover, ZlinkW sessions. |
| - | warning or undesirable conditions, such as failure to get a voice channel in time, printer port “overflow”. Calls may be dropped, but the condition should be self correcting. |
| ? | general error, such as a ZBASE subscriber programming error, or “invalid destination” message resulting as a side effect of a dead station card. Often these are repaired by correcting subscriber records. |
| ! | serious errors, may be hardware failures. Generally this means to call Zetron. |

# Classes of Calls

| Call Type | Description |
|---|---|
| alarm # | Alarm dialer call (if Alarm option in use). |
| alpha # | Alpha access number called. Appears with both the login attempt and the logout or disconnect occurrence. |
| announce | An announcement was played. |
| call | Never got to a valid subscriber ID, so there is no paging or routing mode associated with the event. |
| console | Console/ZLINK activity. |
| group # | Marks the batching of a group call. |
| insure | Insured page, message also left in mailbox. |
| live vc | Live voice call (Breakthrough priority, voice, 1 chan/zone). |
| mailbox | Voice message taken, placed in mailbox. |
| nfy_msg | Notify mode, display message taken and sent. |
| ntfy | Notify mode, voice message taken and PageNote page sent. |
| owner | Owner's access (PageSaver or Greeting menu) by caller. |
| packet | Postings related to TNPP packets (not pages). |
| page | Simple basic page, no mailbox functions. |
| port | Posting related to a TNPP port, status changed, errors. |
| prompt | A status "P" ID was called, prompt access mode. |
| reminder | Notify mode, a reminder PageNote page sent. |
| retrieve | Old form of above. |
| retrv | Retrieval number called, may have resulted in messages being played. |
| route 1 | Internal Forward route 1. |
| route 2 | Internal Forward route 2. |
| tb page | Talkback page (mode "T") call. |
| test pg | A test page started via the "page" command. |
| watchpage | Alarm dialer timeout occurred (it did not call in). |

Following are pages for individual subscribers within a group, shown by the leading “G” and followed by the paging mode of the group master record. The individual subscribers’ pages go out as simple pages, but are logged under the group mode.

| Call Type | Description |
|---|---|
| Bad TC value | Normally should not see this, contact Zetron. |
| Gannounce | Placeholder, not used, should never actually see this. |
| Ginsure | An individual insured page within a group. |
| Glive vc | An individual live voice page within a group, which will be live voice itself. |
| Gmailbox | Placeholder, not used, should never actually see this. |
| Gnfy_msg | An individual notify display message page within a group. |
| Gntfy | An individual notification page within a group. |
| Gpage | An individual ordinary page within a group. |
| Greminder | An individual reminders page within a group. |
| Gtest pg | An individual test page within a group, from doing a test page on a group number. |
| Gwatchpg | Alarm unit timeout occurred (it did not call in), and the watchdog number is a group page. This subscriber is one member of that group. |
| TC error | Normally should not see this, contact Zetron. |

# Results of Calls

## Sucess Results

| Result Type | Description |
|---|---|
| batching | Group call Master, call completed and group is being batched. |
| CRON Q | Placeholder, not currently used, should not see. |
| deleted | Voice file deleted. Custom prompt or Prompt set-up access. |
| done | Test page counted out, all done. |
| end call | End of Alpha access. |
| Iforward | Call was internally forwarded. |
| in done | Alpha session over, or test page started. |
| in prgrs | Group call taken, or alpha login. |
| killed | Test page killed by ZlinkW command. |
| Link Up | The TNPP link for specified port# came up. |
| no answer | Talkback, talkback pager did not answer. |
| played | Played a voice file, announcement mode. |
| recorded | Voice file recorded. Custom prompt or Prompt set-up access. |
| Reset seen | The TNPP port saw a TNPP Reset packet. |
| Reset sent | The TNPP port sent a TNPP Reset packet. This does not mean the packet was <ACK>ed. If a port shows several cases of “Reset sent”, one about every 20 to 60 seconds, then there may be a problem with the TNPP link. |
| saved | Mailbox saved. |
| sent | Page sent successfully. |
| succeeded | Owner access, Message retrieval call. |
| transcrbd | AlphaScribe call, page was transcribed from voice to display. |

## Failure Results

| Result Type | Description |
|---|---|
| bad fcn | Usually failed to enter needed function code. |
| bad number | Number not in database, or is status “I”. |
| dest busy | QueueLimit limit reached - queue limit for Load Management. |
| full | No room to add message to mailbox. |
| hung up | Caller hung up. |
| no access | Passcode/Security code failed. The passcode entered will be posted at right hand end of the line, “----” will be posted if the caller hung up or failed to enter a passcode in time. |
| no billing | Very brief call, caller hung up before billing interval up. |
| no modem seen | Alpha access number did not see modem tones before timeout period elapsed. |
| no msg | Message needed, not entered and “page with empty message” is not set for this subscriber. |
| no resrc | Could not obtain a system resource such as memory or a voice channel. |
| no xmit | Page not sent. Can be caused by a crashed output card (SIU, NIU, ...). For TAP outdial indicates that the card could not get to the point of entering the page onto the target system; this may mean problems with the telephone line or modem, or that the other system is not functional. See “red time” description in TAP section of Operations manual. |
| not xmited | Page not sent (older form of “no xmit”). |
| q full | MaxTalkBack limit reached - queue limit of Talkback pages. |
| rejected | Outside of valid range for trunk. |
| timed out | Overdial caller entered no or not enough digits; or a TNPP packet was not responded to within timeout period. |

## Warning Results

| Result Type | Description |
|---|---|
| bad CRC | A TNPP packet was received with a bad CRC (bad data/noise). |
| CAN reply | The TNPP node being transmitted to responded to the packet with a <CAN>. Either the other terminal has not been programmed to accept this packet's destination address, or the packet format appeared to be improper or not understood. |
| dest down | Channel dead, node offline. (Old form of above message). |
| dst down | Channel dead, node offline. |
| Link Down | The TNPP link for the specified port went down. Note that newer code will give “link down” postings for all active ports at boot-up time. |
| NAK fail | The TNPP packet being sent was responded to with a total of Cretry <NAK>s, without ever seeing an <ACK>. For the default oparam values this means that the packet was <NAK>ed 6 times. |
| No voice chan | Could not obtain voice channel. |
| PS full | PageSaver partition full. |
| retry fail | The packet was not responded to within Tnri/Tnrb, for a total of Cretry retries; or a Link Test after Tnri/Tnrb timeout was not able to establish the link. Generally this indicates some sort of problem with the link between the two terminals. |
| RS fail | The TNPP packet being sent was responded to with a total of Chold <RS> replies, without ever seeing an <ACK>. Indicates that the destination is running out of buffer space, and may be overloaded. Or, a TAP outdial call was rejected, called terminal sent <RS> to reject the page. This often indicates that the subscriber ID was not in the other terminal’s database. |
| SUB-ETB | TNPP, a packet was seen with the non-standard escaping of an <ETB> marker. |
| too big | TNPP received a packet that appeared to be longer than 1Kbyte This may have been caused by noise or receiver overrun. |
| too far | TNPP received a packet that was to be routed out another serial port, and that packet's inertia had reached zero. Such packets will not be routed further to other terminals. Normally indicates that the network is misconfigured, the terminals “upstream” from the Zetron will need to check for misrouting. |
| unk block | A TNPP packet was received that contained a block type that ZPAGE did not know how to process. Generally this means that something besides CAP code or ID pages are being sent to the paging terminal. |
| unk node | A packet being routed through the TNPP card did not have a destination. This may occur because the destination node address has not been programmed into the card’s oparam node table. It also may occur if a packet has been routed to a simplex input-only port. |

## Error Results

**(Usually a ZbaseW programming error)**

| Result Type | Description |
|---|---|
| not valid | Talkback call to no-voice SIU. |
| bad dest | Bad channel number, TNPP destination not known. |
| invld dest | Bad channel, TNPP destination not known. (Old form of above). |
| no channel | Usually invalid override settings. |
| no zone | Usually invalid override settings. |
| no dest | The database record had no destination to which a page could be sent. This could be a side effect of having a dead station card.<br>If a subscriber has several destinations, such as several channel/zone combinations, and one of those is invalid or dead, then only the “bad dest” posting will appear. All of the valid/alive destinations should appear with the “sent” result. If ALL of the destinations are invalid or dead then each destination will have the “bad dest” posting and there will be a final posting of “no dest”. Usually the call will not have been answered; this is not true in the case of groups. |
| Bad Link | Internal forward or retrieval call where the number to forward to is not in the database. |
| bad mode | Mode wrong for attempted operation, i.e. group member with announce only. |
| wrong status | Can not use the database entry in desired mode. A record with “P” status in a group is an example. |
| missing | Group ID not in group.bin (not in group database). |
| ID not found | Group member subscriber ID not active. |
| no batch | Rejected by SIU/NIU. |
| not batched | Rejected by SIU/NIU. (Older form of above). |
| bad site | Alarm site # not in database. |

## System Errors (Call not processed)

| Result Type | Description |
|---|---|
| bad SDR | Invalid record type. Could be a problem in upgrading from older ZPAGE/ ZBASE to current level. |
| Bad TS value | Not normally seen, contact Zetron. |
| bogus ID | Really bad subscriber ID - may be due to a bad trunk card. |
| TS error | Not normally seen, contact Zetron. |

# Typical Bootup Sequence

```
+ *** System restart ***
19jan93 09:10:34a   Unexpected hardware reset
+ 19jan93 09:11:28a  Load management queue limit for channel 1 is now 250
+ 19jan93 09:11:28a  Talkback queue limit for channel 1 is now 2
+ Series 2000 terminal up at 19jan93 09:11:30a
+  Z11885 Acme Voice Page  V(zpa310g9) Oct 09 1992 16:26:51 with DOS 3.31
BIOS 05/01/92
+ CPU type : Zetron combined 576K  0 fd. No disp
+ Installing COM1 with baudrate of 1200
+ Installing COM2 with baudrate of 4800
+ comm: Installed 2 serial ports at 19jan93 09:11:30a
+ Loading 1 cards with xmtrv7d5.img
+ 15
+ Loading 11 cards with 2trnk6e3.img
+ 14  13  11  10  9  8  7  6  5  4  3
+ Loading 1 cards with 8tnpp8bu.img
+ 12

+ Adding network card 12: Zetron TNPP Card 8TNPP8BU  1/14/93
+ SCSI voice file system version 310c  May 05 1992  11:28:03
+ 16 voice channels using 8K buffers, 256K voice RAM used, 768K available
+ Paging from subscriber file "subs2000.bin"
+ Starting up call counts.
+ pre-entered messages available
+ Speech enabled: Used 327680 bytes voice memory;  458752 bytes free.
+Channel 1 is ready on 15|00, supports play of recorded voice.
+ Total of 1 channel tasks started
+ Network task started
+ Total of 22 page tasks started
- 831-5481 insure PS full   09:12:42a 2     13BL        -
   NETF505 port Link Up     09:12:48a *  1,0705N
   NET0000 port Link Up     09:12:49a *  2,0000N
   NET0000 port Reset sent  09:12:49a *  2,0000N
   NET0000 port Reset seen  09:12:50a *  2,0001N
+ 19jan93 09:12:37a  voice system has free space -- messages will be saved
  831-7550 alpha # in prgrs 09:13:06a 1     13BL
  831-7550 alpha # in done  09:13:18a 1     13BL total of 1 transaction
  831-6936 insure sent      09:12:59a 2      4BL    1|00S P1  01910159 D  1 0
   NETF505 page sent        09:12:59a 1  1,0705N    1|00S P2  01544178 D 10 800
   NETF605 page sent        09:12:59a 1  1,0705N    1|00S P2  01503309 D 10 974
  831-5481 group # in prgrs 09:13:04a 2     13BL        -
  741-3486 insure sent      09:13:29a 2     14BL  0,0605N P1  01523820 D  8 738
      0200 Gpage sent       09:13:30a 2     13BL    1|00S G1  00202026
      0201 Gpage sent       09:13:30a 2     13BL    1|00S G1  00202250
  567-2141 owner succeeded  09:13:33a 2      9AL played  1, del  1
  462-7342 page sent        09:13:40a 2     14AL    1|00S G1  00202109 V  4
  567-3825 insure sent      09:13:49a 2     11AL  0,0651N P1  01764949 D  4 237
  567-3923 page sent        09:13:58a 2      4AA    1|00S P2  01964795 D 61 PLE
   NETFE00 page sent        09:13:58a 1  1,0302N    1|00S P2  01976560 D 14 666
  831-6374 ntfy saved       09:14:06a 2     11AL       2M             V 18
? 567-5018 insure no dest   09:16:11a 2     13BA        -
  462-2388 page sent        09:16:15a 2     10BL    1|00S G0  00110191
```

# Paging Traffic Display

The log files are useful for viewing the history of paging activity. If you want to see the paging traffic in real time as it flows through the system, you use the ZlinkW command `traffic`. This will turn your office computer into a display terminal to which the paging system sends the log messages as soon as they happen. When you have seen enough, type the quit command "`q`" and then answer "`y`" to the next question. The example below shows a typical traffic display session:

Sample of ZLINK traffic session (after Comm ZLINK selected & run):

```
Office Computer Screen                    Comments
----------------------------------------  ---------------------------------
Site to call:     Zetron Paging Terminal

Please wait...
dialing 644-1300 via modem on port 2
-- connect
-- ready
25may89 10:05:21p
+ traffic

  Subscriber                Time      Priority      Destination
     ID    Result           Completed      Source           Capcode
  465-7190 Gpage sent       10:50:03a 2      8AL    1|02S P0  01060007 D 11 034-4455 93
  465-7191 Gpage sent       10:50:08a 2      8AL    1|02S D   00000140 D 11 034-4455 93
  465-7265 page sent        10:50:22a 2      7AL    1|00S P0  01080017 D  8 758-8400
  465-7002 alpha # in prgrs 10:51:43a 1      8AL
  465-7039 page sent        10:51:44a 2      7BL    1|00S P0  01060021 D  8 444-1432
  465-7021 page sent        10:51:55a 2      8AL    1|00S P3  01040004 D 66 ERNESTINE
GEROGIANNA  PLEASE
  465-7002 alpha # in done  10:51:55a 1      8AL total of 1 transactions
  465-7181 page sent        10:52:06a 2      7AL    1|02S D   00000078 D  8 650-0169
  465-7181 page sent        10:52:13a 2      7AL    1|00S D   00000078 D  8 650-0169
  465-7010 reminder sent    10:52:31a 4      7BL    1|00S D   00000093 D  7 002 002
  465-7010 ntfy sent        10:54:42a 4      7BL    1|00S D   00000093 D  7 003 002
  465-7021 page sent        10:56:02a 2      8AL    1|00S P3  01040004 D 12 123-4567 890
  465-7228 page sent        10:56:04a 2      7AL    1|00S P0  01060025 D  8 449-9861
  465-7228 page sent        10:57:40a 2      7BL    1|00S P0  01060025 D  8 444*0404
  465-7060 page sent        11:01:48a 2      8AL    1|02S 2   000 B105 V 13
  465-7060 page sent        11:02:07a 2      8AL    1|00S 2   000 B105 V 13
  465-7115 page sent        11:03:22a 2      7AL    1|00S D   00000136 D  8 425-2447
  465-7285 insure sent      11:04:33a 2      7BL    1|00S P0  01050035 V 23
  465-7285 insure sent      11:04:38a 2      7AL    1|00S P0  01050035 D 10 231-4025 *
  465-7189 page sent        11:05:02a 2      8AL    1|00S P0  01060031 D  8 671-1515

q
```

Type Enter to return to ZbaseW.

For an explanation of the fields you see above, see *Log Posting Format* on page 346.

# Appendix A: TAP Protocol Summary

This appendix describes the Telocator Alphanumeric Protocol (TAP), which is a protocol derived from the Motorola iXO protocol.

This is a summary of the specification; the wording of the optional messages are Zetron-specific. For a current copy of the full specification, see the web page for the Paging Technical Committee. This can be found at:

`http://www.pagingcarriers.org/ptc.htm`

# Definitions

| Term | Meaning |
|---|---|
| AED | Alpha Entry Device, this would be any customized terminal or PC configured to send alpha-numeric paging requests to the paging terminal |
| M2x00 | A Zetron Model 2100 or 2200 paging terminal |
| msg | optional TAP transaction messages, enabled/disabled per trunk line, default is active, the ending <LF> is part of the message |

| Character | Meaning | -ASCII decimal | Value-hex | Control Character |
|---|---|---|---|---|
| <CR> | Carriage Return | 13 | 0D | ^M |
| <ESC> | Escape | 27 | 17 | ^[ |
| <ACK> | Acknowledge | 6 | 6 | ^F |
| <NAK> | Negative acknowledge | 21 | 15 | ^U |
| <EOT> | End of transmission | 4 | 4 | ^D |
| <STX> | Start of text | 2 | 2 | ^B |
| <ETX> | End of text | 3 | 3 | ^C |
| <LF> | Line Feed | 10 | 0A | ^J |
| <RS> | Record Separator | 30 | 1E | ^^ |
| <US> | Unit Separator | 31 | 1F | ^_ |

Please note that upper/lower case is important for printable characters, for example, for `<ESC>PG1` the "`P`" and "`G`" must be in upper case.

# Protocol

## Initial Handshake Sequence

1. AED desires to call the M2x00. It initiates the paging sequence, calling the Model 2x00's alpha access #.
2. AED may or may not bring up its modem first (it may wait to see the modem from the Model 2x00).
3. M2x00 answers and brings up its modem.
4. AED then brings up modem if not already up.
5. The modems at both ends establish the communications link.

(This example does not apply for direct serial connections; in that case, the link is always active).

## Initial Logon Sequence

Once initial handshake successful:

| M2x00 sends: (Displayed) | AED sends: | Notes |
|---|---|---|
| — | <CR> | AED requests attention of M2x00. |
| ID= | — | M2x00 responds and requests AED to send the logon ID sequence.<br><br>If the AED does not send the <CR> within 2 seconds the M2x00 will send the "ID=" string on its own. |
| — | <ESC>PG1<CR> | AED logs on without password. |
| | OR | |
| — | <ESC>PG1pppp<CR> | AED logs on with a password. pppp is password 1-n characters long (4 or 6 characters is typical). The password is set per trunk or alpha input line with parameter 10h; most installations use no password. |
| <ACK><CR>msg | — | Logon accepted. msg=* acknowledged *<LF><CR> |
| OR | | |
| <NAK><CR>msg | — | Logon requested again, i.e. please go back to the <ESC>PG1 step above. msg=* retransmit *<LF><CR> |
| OR | | |
| <ESC><EOT>msg | — | Logon denied, terminal hangs up. msg=* bye *<LF><CR> |
| If the logon accepted message was sent then the following sequence will be employed. | | |
| <ESC>[p<CR> | — | Paging terminal ready. |

## Transferring Pages

Once initial logon successful:

| M2x00 sends: (Displayed) | AED sends: | Notes |
|---|---|---|
| — | <STX><pager#><CR><message><CR><ETX><checksum><CR> | Send message to pager#. Pager # is exact # in database. Checksum is arithmetic sum of all preceding 7-bit chars in the block; the 12 LSBs of this sum are grouped into 3 4-bit nybbles, 30h added to each nybble to make 3 ASCII chars. The ASCII characters will be from the set 0-9:;<=>? with any other value being illegal. (See checksum example on following page.) A block can be no longer than 256 characters starting with the <STX> through the final <CR>. The handling of long messages that would exceed the block size limit will be described below. |
| <ACK><CR>msg | — | Page received OK. msg=* acknowledged *<LF><CR> |
| OR | | |
| <NAK><CR>msg | — | Checksum error, retransmit requested. msg=* retransmit *<LF><CR> |
| OR | | |
| <RS><CR>msg | — | Invalid pager #, or too many (3) checksum retries. msg=* transaction rejected *<LF><CR> In practice, the above message is not seen. Instead, you will see one of these:<br>msg=Invalid pager number<CR><LF><CR><br>msg=System error<CR><LF><CR><br>msg=System busy<CR><LF><CR><br>msg=Database error<CR><LF><CR><br>msg=Message required - page cancelled<CR><LF><CR> |
| OR | | |
| <ESC><EOT>msg | — | M2x00 disconnecting. msg=* bye *<LF><CR> The M2x00 will disconnect if the trunk or alpha input line has a timeout programmed and there has been no input for the timeout interval. This forced logout may also occur if too many (3 in a row) <RS> events occur. |

This sequence is repeated for each alpha page to be sent.

If the message string is longer than can be fit into one 256 character block the following method is used.

| M2x00 sends: (Displayed) | AED sends: | Notes |
|---|---|---|
| — | <STX><pager#><CR><br><first portion of message><br><US><checksum><CR> | The page starts off similar to the above example. As the entire message can not be fit within the block it is "broken" at some point that will fit. No <CR> is appended at that point, as the message field is not done, and a <US> byte is used instead of <ETX>. The <US> byte indicates that there is more of the message field to come. |
| reply | — | The M2x00 will respond with one of the four replies described earlier. These are <ACK>, <NAK>, <RS>, or <ESC><EOT> |
| — | <STX><br><remainder of message><CR><br><ETX><checksum><CR> | If the remainder of the message will fit within a block this form is used. The remainder of the message must be 250 characters or less to fit within a continuation block. Note the end of the message is marked with a <CR>, and that there is no pager# field after the <STX> byte.<br>If the remainder of the message would not fit in a single block then the following sequence is used. |
| — | <STX><br><message fragment><br><US><checksum><CR> | This block will contain up to 250 characters of the message. This may be repeated as much as needed until the remainder of the message will fit within a single block.<br>Note that the M2x00 currently will not accept a message longer than 500 characters. |
| — | <STX><br><remainder of message><CR><br><ETX><checksum><CR> | Once again the message is terminated with a <CR>, and the <ETX> byte is used to indicate that this is the last block of the message. |
| reply | — | The M2x00 will respond with one of the four replies described earlier. These are <ACK>, <NAK>, <RS>, or <ESC><EOT> |

-

```
Logoff
```

After all pages have been transmitted the calling party should log off the M2x00. The following sequence happens.

| M2x00 sends: (Displayed) | AED sends: | Notes |
|---|---|---|
| — | <EOT><CR> | Entry device finished, logoff. |
| <ESC><EOT><CR>msg and drop carrier and hang up | — | Acknowledge logoff.<br>msg=* bye *<LF><CR> |
| — | | drop carrier and hang up |

## Checksum Example

| Block characters | ASCII Hex values |
|---|---|
| <STX> | 02 |
| 1 | 31 |
| 2 | 32 |
| 3 | 33 |
| <CR> | 0D |
| A | 41 |
| B | 42 |
| C | 43 |
| <CR> | 0D |
| <ETX> | 03 |
| | 17B |

The 12 bit checksum 17B hex is split into three 4 bit nibbles as 01, 07, 0B. An ASCII “0”, value 30 hex, is then added to each nibble. The result is a string of three characters, 31 37 3B in hex or “17;” in ASCII. Note that the checksum may be calculated as a 16 bit number for convenience, the high 4 bits would be ignored when preparing the ASCII form of the checksum.

The complete block would be: “<STX>123<CR>ABC<CR><ETX>17;<CR>”

# Appendix B: ASCII Table — 7 Bit

## Control Codes

A table of the printable ASCII characters is provided on the next page.

| Dec | Hex | Ctrl | Mnem | Name | Dec | Hex | Ctrl | Mnem | Name |
|---|---|---|---|---|---|---|---|---|---|
| 0 | 0 | ^@ | NUL | Null (all zero) | 16 | 10 | ^P | DLE | Data link escape |
| 1 | 1 | ^A | SOH | Start of header | 17 | 11 | ^Q | DC1 | Device ctrl 1/XON |
| 2 | 2 | ^B | STX | Start of text | 18 | 12 | ^R | DC2 | Device ctrl 2 |
| 3 | 3 | ^C | ETX | End of text | 19 | 13 | ^S | DC3 | Device ctrl 3/XOFF |
| 4 | 4 | ^D | EOT | End of transmission | 20 | 14 | ^T | DC4 | Device ctrl 4 |
| 5 | 5 | ^E | ENQ | Enquiry | 21 | 15 | ^U | NAK | Negative ACK |
| 6 | 6 | ^F | ACK | Acknowledge | 22 | 16 | ^V | SYN | Synchronous idle |
| 7 | 7 | ^G | BEL | Bell | 23 | 17 | ^W | ETB | End trans. block |
| 8 | 8 | ^H | BS | Backspace | 24 | 18 | ^X | CAN | Cancel |
| 9 | 9 | ^I | HT | Horizontal tab | 25 | 19 | ^Y | EM | End of medium |
| 10 | A | ^J | LF | Line feed | 26 | 1A | ^Z | SUB | Substitute |
| 11 | B | ^K | VT | Vertical tab | 27 | 1B | ^[ | ESC | Escape |
| 12 | C | ^L | FF | Form feed | 28 | 1C | ^\ | FS | File separator |
| 13 | D | ^M | CR | Carriage return | 29 | 1D | ^] | GS | Group separator |
| 14 | E | ^N | SO | Shift out | 30 | 1E | ^^ | RS | Record separator |
| 15 | F | ^O | SI | Shift in | 31 | 1F | ^_ | US | Unit separator |

# Printable Characters

| Dec | Hex | Char | Dec | Hex | Char | Dec | Hex | Char |
|---|---|---|---|---|---|---|---|---|
| 32 | 20 | space | 64 | 40 | @ | 96 | 60 | ` |
| 33 | 21 | ! | 65 | 41 | A | 97 | 61 | a |
| 34 | 22 | " | 66 | 42 | B | 98 | 62 | b |
| 35 | 23 | # | 67 | 43 | C | 99 | 63 | c |
| 36 | 24 | $ | 68 | 44 | D | 100 | 64 | d |
| 37 | 25 | % | 69 | 45 | E | 101 | 65 | e |
| 38 | 26 | & | 70 | 46 | F | 102 | 66 | f |
| 39 | 27 | ' | 71 | 47 | G | 103 | 67 | g |
| 40 | 28 | ( | 72 | 48 | H | 104 | 68 | h |
| 41 | 29 | ) | 73 | 49 | I | 105 | 69 | i |
| 42 | 2A | * | 74 | 4A | J | 106 | 6A | j |
| 43 | 2B | + | 75 | 4B | K | 107 | 6B | k |
| 44 | 2C | , | 76 | 4C | L | 108 | 6C | l |
| 45 | 2D | - | 77 | 4D | M | 109 | 6D | m |
| 46 | 2E | . | 78 | 4E | N | 110 | 6E | n |
| 47 | 2F | / | 79 | 4F | O | 111 | 6F | o |
| 48 | 30 | 0 | 80 | 50 | P | 112 | 70 | p |
| 49 | 31 | 1 | 81 | 51 | Q | 113 | 71 | q |
| 50 | 32 | 2 | 82 | 52 | R | 114 | 72 | r |
| 51 | 33 | 3 | 83 | 53 | S | 115 | 73 | s |
| 52 | 34 | 4 | 84 | 54 | T | 116 | 74 | t |
| 53 | 35 | 5 | 85 | 55 | U | 117 | 75 | u |
| 54 | 36 | 6 | 86 | 56 | V | 118 | 76 | v |
| 55 | 37 | 7 | 87 | 57 | W | 119 | 77 | w |
| 56 | 38 | 8 | 88 | 58 | X | 120 | 78 | x |
| 57 | 39 | 9 | 89 | 59 | Y | 121 | 79 | y |
| 58 | 3A | : | 90 | 5A | Z | 122 | 7A | z |
| 59 | 3B | ; | 91 | 5B | [ | 123 | 7B | { |
| 60 | 3C | < | 92 | 5C | \ | 124 | 7C | \| |
| 61 | 3D | = | 93 | 5D | ] | 125 | 7D | } |
| 62 | 3E | > | 94 | 5E | ^ | 126 | 7E | ~ |
| 63 | 3F | ? | 95 | 5F | _ | 127 | 7F | (del) |

# Appendix C: Decimal to HEX Conversion

## Overview

It is easiest to convert from Decimal to Hex using a calculator. Some hand-held calculators will do this; so will some personal computer calculators such as Borland's SideKick (tm). If these are not available, you can use the following method.

Find the place in the “Hex Divisors” table where your decimal number is between two decimal numbers in the table. Take the smaller decimal divisor number and divide your number by it. This will result in a number from 0 to 15, plus (usually) some remainder. Look the number up in the “Decimal to Hex Digit” table and write down the digit value. Take the decimal value, multiply by the divisor, and subtract the result from your original number. This leaves the number for the next step - repeat this process. When you get a final remainder between 0 and 15, that is the last digit.

### Hex Devisors

| Decimal | Hex |
|---:|---:|
| 1 | 1 |
| 16 | 10 |
| 256 | 100 |
| 4096 | 1000 |
| 65536 | 10000 |
| 1048560 | 100000 |
| 16776960 | 1000000 |

### Decimal to Hex Digit

| Decimal | Hex |
|---|---|
| 0 | 0 |
| 1 | 1 |
| 2 | 2 |
| 3 | 3 |
| 4 | 4 |
| 5 | 5 |
| 6 | 6 |
| 7 | 7 |
| 8 | 8 |
| 9 | 9 |
| 10 | A |
| 11 | B |
| 12 | C |
| 13 | D |
| 14 | E |
| 15 | F |

## Examples

Example: Convert 2020 decimal to hex.

| | |
|---|---|
| 2020 | Between 256 and 4096, divide by 256, gives 7.something. In decimal to hex digit table, 7 becomes 7. Write down 7 (1st (leftmost) digit). Multiply 7 * 256, gives 1792. Subtract 1792 from 2020, leaves 228. |
| 228 | Between 16 and 256, divide by 16, gives 14.something. In decimal to hex digit table, 14 becomes E. Write down E (2nd (next) digit). Multiply 14 * 16, gives 224. Subtract 224 from 228, leaves 4. |
| 4 | Between 1 and 16, final digit, no division needed. In decimal to hex digit table, 4 becomes 4. Write down 4 (3rd (last, rightmost) digit). |
| Done | Result is: 7E4 |

To check: Multiply each digit by its position value, and add together, for example:

```
7    7 x 256 =     1792 +
E    14 x 16 =     0224 +
4    4 x 1 =       0004
                   2020
```

# Index


## A

adjustment procedures, 77
alignment procedure, 30
alpha messaging, trunk cards, 18
audio bandwidth, 18
audio output, telco, 18

## B

backups for data files, 65
batching, station cards, 21
bootup sequence, typical, 358

## C

cable routing, 36
calls
    classes of, 352
    results of, 354
classes of calls, 352
co-located Motorola PURC station, 112
co-located radio station, 110
command reference for ZlinkW, 314
compatible controllers of station cards, 22
configuring communications from within ZlinkW, 309
configuring for DID operation, 90
configuring for end-to-end loop start, 91
configuring for PABX operation, 92
configuring the Digi One option, 43
configuring trunk cards, 86

## D

Digi One option, 43
digital encoding for station cards, 22
digital T1 interface
    specifications, 20
DOC registration, trunk cards, 18
DTMF detect, 18
dual trunk card memory upgrade, 94

## E

end of message, voice storage, 23, 24
end-to-end loop start operation, 91
exiting ZbaseW, 64
exiting ZlinkW, 308

## F

FCC registration, trunk cards, 18
format encoding for station cards, 22

## H

hard disk card mounting information, 32

## I

installation checklist, 26
installing office software, 57
installing the Digi One option, 43
installing the m2200EX, 39
installing ZbaseW for multiple users, 57
installing ZlinkW, 308

## K

keying outputs for station cards, 22

## L

LEDs, voice storage, 23, 24
lightning protection, 17
local phone, specifications, 20

## M

M2100
    power supply, 16
    specifications, 16
m2100 cabinet mounting, 36
M2200
    power supply, 16
    specifications, 16
m2200 cabinet mounting, 36
M2200EX
    power supply, 17
    specifications, 17
m2200EX installation, 39
making a connection from ZbaseW, 312
memory upgrade for dual trunk card, 94
message length, voice storage, 23, 24
mosre code ID, station cards, 21
mounting the hard disk card, 32
mounting the m2100 cabinet, 36
mounting the M2200 cabinet, 36
mounting the SCSI disk card, 32
multiple-user ZbaseW, 57
multi-port card
    specifications, 21

## O

office computer operations guidelines, 66
office computer specifications, 55
office software installation, 57
operating power, 17
operation, voice storage, 23, 24
operations guidelines for office computer, 66
operator local phone, specifications, 20
operator local station, 91
overview of communication with paging terminal, 307

## P

PABX E&M type 1 specifications, 19
PABX operation, configuring, 92
paging traffic display, 359
pause compression, voice storage, 23, 24
phone line, selecting, 71
posting, 351
printer option, 42

## R

radio connectors, 98
radio signal descriptions, 109
receive audio for station cards, 22
remote control of station cards, 21
remote control options, radio, 113
removal/installation, station card, 105
results of calls, 354

## S

SCSI disk card mounting information, 32
selecting a phone line, 71
serial printer port, ZCPU, 42
signaling formats, station cards, 21
specifications
    DID selector level, 19
    digital T1 interface, 20
    end-to-end, 19
    local phone, 20
    M2100, 16
    M2200, 16
    M2200EX, 17
    multi-port card, 21
    PABX E&M type 1, 19
    PABX extension, 19
    PABX trunk, 19
    station cards, 21
    trunk cards, 18
    voice system, 23
starting ZbaseW, 59
starting ZlinkW, 308
station card adjustments, 107
station card removal/installation, 105
station cards
    batching, 21
    compatible controllers, 22
    connector, 21
    digital encoding, 22
    format encoding, 22
    keying outputs, 22
    morse ID, 21
    receive audio, 22

remote control, 21
signaling formats, 21
specifications, 21
station handshaking, 22
status lamps, 21
transmit audio, 22
zone select, 22
station handshaking for station cards, 22
status lamps, 18
station cards, 21
support for T1 trunks, 71


## T


T1 trunks, support for, 71
telco audio output, 18
telco connectors, 72
telco ground reference, 33
transmit audio for station cards, 22
trunk cards
alpha messaging, 18
audio bandwidth, 18
DOC registration, 18
DTMF detect, 18
FCC registration, 18
specifications, 18
status lamps, 18
typical bootup sequence, 358


## U


uninterruptible power supply (UPS), 17


## V


voice system
audio bandwidth, 23, 24
audio in/out, 23, 24
end of message, 23, 24
LEDs, 23, 24
message length, 23, 24
operation, 23, 24
pause compression, 23, 24
recording method, 23, 24
storage, 23, 24
voice system specifications, 23


## Z


ZbaseW
communications (ZlinkW), 60
exiting, 64
for multiple users, 57
making a connection, 312
starting, 59
ZCPU serial printer port, 42
ZlinkW
command reference, 314
configuring communications, 309
exiting, 308
installing, 308
posting, 351
starting, 308
zone select for station cards, 22